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Heie (O.). **Studier over løgbladlusen** (*Myzus ascalonicus* **Doncaster**) **i Danmark i foråret 1957.** [Studies on the Shallot Aphis, *M. ascalonicus* in Denmark in the Spring of 1957.]—*Tidsskr. Planteavl* **61** pt. 4 pp. 737–748, 4 figs., 5 refs. Copenhagen, 1957. (With a Summary in English.)

Myzus ascalonicus Doncaster, which was recently found in glasshouses in Denmark [*cf. R.A.E.*, A **46** 79], was observed there on stored shallots in a cellar and on swedes in clamps in the spring of 1957. In laboratory tests, the Aphid seemed to prefer etiolated plant parts, but did not avoid light.

Kanervo (V.), Heikinheimo (O.), Raatikainen (M.) & Tinnilä (A.). **The Leafhopper** *Delphacodes pellucida* **(F.) (Hom., Auchenorrhyncha) as the Cause and Distributor of the Damage to Oats in Finland.** [*In English & Finnish.*]—*Valt. Maatalousk. Julk.* no. 160, 56 pp., 20 figs., 20 refs. Helsinki, 1957.

Oats grown on the west coast of Finland have since 1949 suffered from a condition involving severe discoloration of the leaves and loss in yield, so that cultivation of this crop has had to be abandoned in some areas. Since 1954–55, the affection has spread inland. Investigations begun in 1955 showed that it was due to feeding by *Delphacodes pellucida* (F.) [*cf. R.A.E.*, A **13** 538], which was abundant in the areas of damage and also outside them. It is not known whether transmission of a virus is involved. The Delphacid was found to have one generation a year. It overwintered in the third or fourth nymphal instars, and resumed activity in May. Adults appeared in June, flew in swarms and oviposited in July, and the eggs were inserted into the stalks of oats, other cereals and various grasses. The nymphs hatched at the end of July, fed on the plants, and overwintered on the soil. Most of those hibernating in fields of cereals were destroyed by ploughing or harrowing in spring, so that the adult population was largely derived from fields of timothy [*Phleum pratense*]. Several natural enemies of *D. pellucida* were observed, of which the most important was *Elenchus tenuicornis* (Kby.), a Strepsipterous parasite of the adults that prevented oviposition. In laboratory tests, dusts of parathion and malathion and sprays of these and methyl-demeton [dimethyl 2-(ethylthio)ethyl phosphorothioate] gave good control, but the results of field experiments were rather inconclusive, owing to uncertainty as to timing, and it is feared that insecticidal control alone might prove too expensive. Supplementary methods are being investigated.

Hill (A. R.). **The Biology of** *Anthocoris nemorum* **(L.) in Scotland (Hemiptera: Anthocoridae).**—*Trans. R. ent. Soc. Lond.* **109** pt. 13 pp. 379–394, 3 figs., 17 refs. London, 1957.

An account is given of field and laboratory observations in Scotland on the life-cycle, feeding habits and prey of the predacious bug, *Anthocoris nemorum* (L.), which is of importance in orchards [*cf. R.A.E.*, A **41** 158], together with descriptions of all stages. Overwintered females emerged between 23rd March and 16th April and began ovipositing about ten days later, and most continued to oviposit for at least five weeks. The eggs hatched after about a week and nymphal development required 34–56 days in the laboratory, during which each nymph consumed 45–77 Aphids; in the field, development lasted 93–97 days. Pairing occurs in late summer

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and autumn, and few males survive the winter. There is only one generation a year, though farther south in Britain at least two are produced [*cf.* also **45** 2].

Essig (E. O.). **Insects and Mites of western North America.**—2nd edn., 9¼ × 6 ins., xiii + 1050 pp., 779 figs., many refs. New York & London, Macmillan Co., 1958. Price £6 8*s*.

This is the second edition of a work on the insects and other terrestrial arthropods of the western United States and Canada originally published in 1926 [*R.A.E.*, A **15** 151]. It resembles the first edition in scope and arrangement, but the nomenclature has been revised and some additional species are included.

Silveira Guido (A.), Carbonell Bruhn (J. F.), Núñez (O.) & Valdés (E.). **Investigaciones sobre acridoideos del Uruguay (sistemática, morfología, citología, economía, habitat, ciclo biológico, costumbres, ecología, geografía, enemigos naturales y control). Primera contribución.** [Investigations on Acridids of Uruguay (Systematics, Morphology, Cytology, Importance, Habitat, Biological Cycle, Habits, Ecology, Geography, Natural Enemies and Control). First Contribution.]—485 pp., 3 col. pls., 313 figs., 29 maps, 5 graphs, 19 refs. Montevideo, Cátedra Ent., Fac. Agron., Univ. Uruguay, 1958.

The Acridids dealt with in this work comprise 28 species of grasshoppers that are indigenous in Uruguay, and the scope of the information given on them is indicated by the title. All contribute to the denudation of grazing lands, and the most important in this respect are *Scyllinops bruneri* (Rehn), *Dichroplus pratensis* Bruner, *D. conspersus* Bruner, *Parorphula graminea* Bruner, *S. pallida* (Bruner), *Orphulella punctata* (Deg.), *Allotruxalis strigata* (Bruner) and *D. punctulatus* (Thnb.). Various dusts were tested for control in the laboratory and field, chiefly against *S. bruneri*; BHC proved effective in the former, but the results of the field tests were unsatisfactory.

van Dinther (J. B. M.). **Insects of the Coconut Palm in Suriname.**—*Bull. LandbProefst. Suriname* no. 69, 27 pp., 9 figs., refs. Paramaribo, 1956.

A list is given of 20 species of insects found on coconut palms in Dutch Guiana during a survey in 1953–55, with notes on their morphology, information on the bionomics and control of some, and pertinent references to the literature. The only ones of importance as pests are *Castnia daedalus* (Cram.), the larvae of which bore in the stems, *Strategus aloeus* (L.), the adults of which bore in the stems of young palms, *Brassolis sophorae* (L.), of which the larvae feed on the leaves, and *Aspidiotus destructor* Sign., which infests the leaves and sometimes the green fruits, but seldom kills trees of bearing age.

Pujol (R.). **Étude préliminaire des principaux insectes nuisibles aux colatiers.**—*J. Agric. trop. Bot. appl.* **4** no. 5–6 pp. 241–264, 9 figs., 102 refs. Paris, 1957.

The author reviews, from the literature and his own observations, the numerous insects that attack *Cola* trees in French West Africa, and gives

information on their habits, injuriousness and sometimes control, arranging them according to the plant part concerned. They fall into three groups, of which the first consists of species that feed on many plants other than *Cola*. *Zonocerus variegatus* (L.) and *Brachytrupes membranaceus* (Dru.) are typical of it. The second and most numerous group consists of insects that attack both *Cola* and cacao, and this includes such well-known cacao pests as *Sahlbergella singularis* Hagl., *Distantiella theobromae* (Dist.), *Planococcus* (*Pseudococcus*) *citri* (Risso) and *Pseudococcus njalensis* Laing. The third group consists of a few species more or less restricted to *Cola*, of which the most important are *Balanogastris kolae* (Desbr.) [*cf. R.A.E.*, A **45** 169], *Paremydica* sp. and *Ceratitis colae* Silv., which injure the nuts, *Anaphe venata* Btlr., which feeds on the leaves, causing defoliation, and *Phosphorus* spp., which bore in the trunks.

Smit (B.). **The Control of Stored Grain Insects in South Africa.**—*Bull. Dep. Agric. S. Afr.* no. 355, 36 pp., 11 figs., 1 fldg. table. Pretoria, 1957.

This bulletin contains notes on the appearance and bionomics of the more important insects that attack stored grain in South Africa, together with information on the control and prevention of infestation by methods of storage and the use of inert and insecticidal dusts, sprays and fumigation and a table showing the properties, uses, rates of application and toxicity to insects and man of the fumigants in common use. It is stated in the course of it that *Trogoderma granarium* Everts was found for the first time in South Africa [*cf. R.A.E.*, A **45** 370] in a brewery in Pietermaritzburg in 1954. A much more serious outbreak was found in 1956 in a mill near Pretoria, where sweepings had been piled up in bags for about three years. As some of this infested material had been sold from time to time, it is feared that the beetle may now be fairly widely distributed.

McKinlay (K. S.). **A preliminary Note on the Control of the Red Bollworm, *Diparopsis castanea*, with Insecticides.**—*Emp. Cott. Gr. Rev.* **34** no. 4 pp. 253–257, 1 graph. London, 1957.

Two tests on the control of *Diparopsis castanea* Hmps. on cotton were carried out in the Swaziland Protectorate in 1956–57. In the first, low-volume sprays were applied at 12 gals. per acre to cotton of a South African variety ten times at weekly intervals from 28th November, when infestation was first observed, to 31st January, when the vegetation became too dense for further spraying. Weekly counts of infested squares showed that the best control was given by endrin at 0·5 lb. per acre, followed by 0·25 lb. endrin, 2 lb. DDT (alone or with 0·5 lb. BHC), 1 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], and 1 lb. DDT with and without 0·25 lb. BHC per acre, all of which had some effect. Examination of green bolls between 11th and 16th February showed that *D. castanea* was much more numerous than *Heliothis armigera* (Hb.) or *Earias* sp. and confirmed that endrin gave the best control. *Aphis gossypii* Glov. increased considerably during a dry period in December on the plants treated with DDT alone, but not on any of the others. Since the control given by endrin fell off considerably after mid-January, it was suspected that the volume of spray applied was insufficient to cover the grown plants completely, and 0·025 per cent. endrin and 0·1 per cent. malathion were therefore applied to run-off on other cotton six times weekly. Counts on 22nd March, after the last application, showed that endrin gave complete control of all three species, and malathion good control.

Büttiker (W. W.) & Bünzli (G. H.). **Biological Notes on Southern Rhodesian Tobacco Pests (1). Records of Hostplants of adult Chafer Beetles.**—*Rhod. agric. J.* **54** no. 5 pp. 462–472, 4 refs.; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1938, 12 pp., 4 refs. Salisbury, S. Rhod., 1957.

Work in 1948–52 on the Lamellicorns that are injurious in the larval stage to tobacco in Southern Rhodesia showed that the most important species concerned are *Anomala exitialis* Pér., *A. pinguis* Pér., *A. opacicollis* Pér., *Schizonycha profuga* Pér., *S. citima* Pér. and *Hecistopsilus molitor* Kolbe. The adults shelter in the soil by day and feed at night, and so usually remain unnoticed. Surveys of the plants on which they feed, the results of which are here given in detail, showed that the beetles are polyphagous, and that most indigenous trees and bushes are susceptible to attack, though a few are immune. Flowers and young leaves were particularly attractive. Low-growing perennials and grasses were little attacked. In tests with *A. exitialis*, complete mortality was given in 2·5 hours by tarsal contact with dusts containing 2 per cent. parathion or 3 per cent. technical BHC and in 3 hours by 5 per cent. DDT. Other insecticides were much less rapid in action. In view of their polyphagous habits, the prospects of controlling the adults by the application of insecticides are not promising.

Galichet (P. F.). **Contribution à l'étude de** *Lobotrachelus nigricornis*, **Hustache parasite d'***Hibiscus cannabinus*.—*Cot. et Fibr. trop.* **12** fasc. 2 pp. 283–287, 4 figs., 1 ref. Paris, 1957.

Observations on the bionomics of *Lobotrachelus nigricornis* Hust. on *Hibiscus cannabinus* in the Chad territory of French Equatorial Africa showed that the larva of this weevil generally enters the stem at a leaf axil, bores in the pith for a distance of 2–3 ins. and pupates in a cell just beneath the bark. The section of the stem preferred is that about 16–44 ins. above soil level, and most of the pupal cells were found to be on the north and east sides. Larvae were present chiefly at the end of the season, when the plants were already drying up, and their economic importance was therefore not great except in plants allowed to persist after the normal harvest time, in which over 100 galleries per plant were occasionally observed.

Report of the West African Timber Borer Research Unit, 1953–55.—44 pp., frontis., 1 pl., 4 graphs, 2 refs. London, 1957.

The West African Timber Borer Research Unit came into being in January 1953, with headquarters in Ghana, and its activities up to 30th September 1955 are reviewed in this report. The research carried out was concerned with the infestation of West African timbers by ambrosia beetles (Scolytids and Platypodids), and the following is based on the general summary of the results.

The ambrosia-beetle fauna of Nigeria and Ghana is comprised of numerous species; 14 species of Scolytids, almost all of the genus *Xyleborus*, and 25 Platypodids, mainly of the genera *Doliopygus* and *Platypus*, were identified, and many others await determination. Most of the species are crepuscular in habit, appearing on the wing at dawn and dusk. Infestation of the logs can occur within one hour of the tree being felled, and it continues at a steady rate for over 20 weeks. In the case of the Platypodids, infestation is characterised by the appearance of the males some 24 hours before the females. Host specificity is not a marked feature of the commoner ambrosia species, and one species of beetle may infest a wide variety of timbers. Galleries are established in the sapwood of the log and frequently

extend to the innermost core of the heartwood. The presence of the black-staining " ambrosia fungus " as a lining on the tunnel walls is a constant feature of the galleries of all species. The average length of the life-cycle of the commoner ones is about six weeks. The ambrosia beetles are preyed upon by insect predators, including ants, Heteroptera, Clerids and Brenthids.

The ambrosia beetle population is maintained at a high level through the year, with little or no seasonal fluctuation in numbers. No correlation of population density with climatic conditions was established. The 20 common timber-tree species used in the investigations exhibited widely differing degrees of susceptibility to attack, but none was completely immune. All log surfaces, both round and cross-cut, sustain attack, and infestation occurs irrespective of the presence or absence of bark, bark thickness, the girth of the log, the density of the wood and its starch content. Logs on both shaded and exposed sites are susceptible to infestation. The removal of bark renders logs highly attractive to ambrosia beetles but prevents infestation by Longicorns and other major timber pests. The retention of bark reduces the intensity of ambrosia beetle attack, but permits infestation by other boring beetles. Logs stored on skids suffer less heavy infestation than those stored on the ground. The application of insecticides to logs resulted in a significant degree of protection against ambrosia beetles and timber pests in general; sprays of γ BHC in oil provided protection for 10–12 weeks under conditions of heavy rainfall.

Bradley (J. D.). **Taxonomic Notes on** *Leucoptera meyricki* **Ghesquière and** *Leucoptera coffeella* **(Guérin-Méneville) (Lepidoptera, Lyonetiidae).**—*Bull. ent. Res.* **49** pt. 3 pp. 417–419, 7 refs. London, 1958.

A species of *Leucoptera* that mines the leaves of coffee in East Africa has long been thought to be *L. coffeella* (Guér.), but examination of East African specimens labelled *L. coffeella* in the British Museum and others collected in Kenya and Tanganyika in 1957 showed that all are referable to *L. meyricki* Ghesq., which was described from Kenya in 1940 from specimens previously identified as *L. coffeella*. Records of *L. coffeella* from these countries [*cf. R.A.E.*, A **44** 92, etc.] are therefore based on misidentification. A lectotype is designated for *L. meyricki*, which is at present known only from Kenya and Tanganyika, but may be more widely distributed in the Old World. The type of *L. coffeella*, which was described from the West Indies, cannot be traced, and the author's determination of this species is based almost entirely on a series of specimens from Trinidad reared from *Coffea canephora* in April 1957. These agreed fairly well with Guérin-Méneville's figures, but differed markedly in wing venation from that depicted for *L. coffeella* by Silvestri [**34** 10]. This species appears to be neotropical and can at present be recorded with certainty only from the West Indies and coffee-growing areas of South America. *L. meyricki* and *L. coffeella* are closely related and congeneric, but show differences of possible generic importance from *L. spartifoliella* (Hb.), the type of *Leucoptera*. Silvestri erected the new genus *Perileucoptera* for *L. coffeella* [**34** 10], but further examination is necessary before this can be adopted.

Whalley (P. E. S.). **An Account of the Weevil Larvae bred from the Banana Plant in Uganda, with a Description of the Larva of** *Temnoschoita nigroplagiata* **(Qued.) (Col., Curc.).**—*Bull. ent. Res.* **49** pt. 3 pp. 421–426, 4 figs., 9 refs. London, 1958.

The author reviews the distribution of *Cosmopolites sordidus* (Germ.) and *Temnoschoita nigroplagiata* (Qued.) in Uganda, where both infest living

pseudostems of banana [*cf. R.A.E.*, A **46** 367], describes the larva of *T. nigroplagiata*, and lists characters differentiating the larvae and pupae of that weevil and *C. sordidus*.

ROFFEY (J.). **Observations on the Biology of *Trox procerus* Har. (Coleoptera, Trogidae), a Predator of Eggs of the Desert Locust, *Schistocerca gregaria* (Forsk.).**—*Bull. ent. Res.* **49** pt. 3 pp. 449–465, 1 pl., 13 figs., 15 refs. London, 1958.

The larvae of *Trox procerus* Har. feed on the eggs of *Schistocerca gregaria* (Forsk.) in the soil, and in this paper, which is based on the literature and recent observations in various countries, the immature stages of this beetle are described, records of its occurrence in egg-fields of *S. gregaria* summarised in a table, and information on its bionomics brought together. The species occurs in India, Saudi Arabia, Kenya, Eritrea, Somalia and Ethiopia [*cf. R.A.E.*, A **40** 98], though some of the records are based on larvae only. The eggs and larvae are known only from egg-fields of *S. gregaria* and have been found in soils varying from hard gravelly silt to soft sand. The adults feed on dead locusts and scraps of other animal matter and may be attracted to the mature and ovipositing swarms of *S. gregaria* by the large numbers of dead locusts among them. The eggs appear to be laid in small batches and were found in tunnels made by the adults in Ethiopia and in soil under or beside egg-pods in Eritrea. Only larvae in the second and third instars were observed to feed on the locust eggs; a larva was estimated to consume one egg every 4–5 hours. In Saudi Arabia, characteristic mounds made on the surface of the soil by the second-instar larvae, possibly for ventilation, provide reliable indications of the presence of *Trox*, or even of locust egg-fields, and also of the *Trox* density. The third-instar larvae become fully fed about 14 days after the deposition of the locust eggs, when the latter are hatching, and then descend to a depth of over 20 ins., where they pupate in cells 15–20 days later. The pupal stage lasts about 25 days. Records of the egg mortality due to *Trox* indicate that it may be of importance in some areas and seasons, but is generally not decisive in controlling populations. Larvae of *Stomorhina lunata* (F.) were the most important of the other agents causing egg mortality in Saudi Arabia, but evidence was obtained that they were destroyed by *Trox*.

SCHEEPERS (C. C.), EYSSELL (B. J.) & GUNN (D. L.). **Density Distributions of Hoppers of the Red Locust, *Nomadacris septemfasciata* (Serv.) (Orth., Acrid.), in Relation to Control by Insecticides.**—*Bull. ent. Res.* **49** pt. 3 pp. 467–478, 1 graph, 17 refs. London, 1958.

The following is taken almost entirely from the authors' summary. Emigration of *Nomadacris septemfasciata* (Serv.) from an outbreak area is preceded by the formation of swarms, and it is desirable in controlling this locust to economise insecticide by allowing congregation to begin but not to proceed to a stage at which migration occurs. In continuation of a study of the process of swarm formation [*cf. R.A.E.*, A **46** 301], undertaken to facilitate the planning of control measures, the population distribution of about 4½ million hoppers was investigated over 1,052 acres in the Iku outbreak area of the Rukwa Valley, Tanganyika, between 18th January and 24th February 1957 to see whether they showed a tendency to congregate and so to produce, immediately after the final moult, adult swarms from populations originally more scattered. From 25th January onwards, the estimated population remained constant in numbers. Densities of over

50 per sq. yd. were unusual and, when a continuous infestation of over one per sq. yd. was taken as a band, the mean density of hoppers in bands was 15 per sq. yd. There was a tendency for such bands to become larger by fusion and for the area quite free from locusts to increase slightly, but the number of dispersed locusts increased. There would therefore have been no advantage in postponing control in the hope of attacking denser and more economical targets. Under the conditions described, it seems probable that the behaviour of the young adults is the most important in the formation of dense swarms, whereas in certain other species concentrated egg-laying and the behaviour of hoppers are also important.

Robertson (I. A. D.). **The Reproduction of the Red Locust,** *Nomadacris septemfasciata* **(Serv.) (Orthoptera, Acrididae), in an Outbreak Area.**—*Bull. ent. Res.* **49** pt. 3 pp. 479–496, 9 figs., 13 refs. London, 1958.

The following is based on the author's summary. During the four breeding seasons of 1952–55, samples of females of *Nomadacris septemfasciata* (Serv.) were caught at intervals in the Rukwa Valley, Tanganyika, and the ovaries arranged in five classes according to egg length. Population estimates and rainfall records were also made. The data suggested that the eggs in the ovaries develop very rapidly and are ready to be laid about seven days after their development has begun. The increase in weight of an individual female during ovary development was related to absolute size and amounted to approximately 50 per cent. The most important factor initiating ovarian development [*cf.* also *R.A.E.*, A **46** 369] seemed to be a drop in daily maximum temperature to below 36°C. [96·8°F.]. The factors of high humidity and rainfall were of less importance, but their influence is not fully understood. The possibility that change in length of day is an important factor in the initiation of ovarian development is discussed. The limiting factors for the number of egg-pods laid in a season are considered to be the dates of the drop in daily maximum temperature and of the drop or decline in parental population; the latter date appears to be connected with the former. The percentages of females laying more than one egg-pod were found to vary considerably from year to year, although the average of 1·7 pods per female agreed with past estimates [*cf.* **40** 6; **41** 236]. Also, the average period of 16 days between successive egg-layings agreed with past work. Drought during the laying period seemed to cause the females to retain their mature eggs. The evidence tended to confirm the possibility that a population of *N. septemfasciata* can increase a hundredfold in a year [*cf.* **44** 261–2].

Casimir (M.). **An experimental Campaign with light Aircraft against flying Locust Swarms in New South Wales.**—*Bull. ent. Res.* **49** pt. 3 pp. 497–508, 1 pl., 1 map, 10 refs. London, 1958.

The following is virtually the author's summary. A campaign in New South Wales against flying swarms of *Chortoicetes terminifera* (Wlk.), using Tiger Moth light aircraft, was carried out in November–December 1955. Large rolling swarms of this locust, travelling across the open plains of western New South Wales, are directed in their general south-easterly movement by natural barriers in such a way that regular migration routes are followed and predictions of swarm movements can be made. Of particular importance are the timber fringes of creeks and rivers, which tend to baulk swarms temporarily, and it was in such situations that locust swarms proved most susceptible to treatment by a manoeuvrable aircraft.

A technique of drift spraying was developed wherein aircraft were able to operate without ground direction against travelling swarms by spraying at right-angles to the wind direction and by using the main body of the flying locusts for demarcation. Large numbers of short spraying runs were made in rapid succession over the most dense portions of the swarm until control was achieved. It was found that the spacing of the runs was not particularly important as long as each was applied to the densest portion of the swarm. The light and relatively slow-moving Tiger Moths proved highly suitable for this work, and they were also useful for scouting and keeping track of swarms. Observations made after spraying indicated that the coherent flying swarms treated in the open plains were almost completely eliminated. If, however, swarms were able to reach closely settled or heavily timbered areas, they tended to split and disperse and were difficult to treat. The insecticide used was an emulsifiable concentrate containing 7 per cent. γ BHC, which was diluted with diesel oil, and 1 gal. liquid containing 5·6 oz. γ BHC was designed to cover one acre. However, as the campaign progressed, effective use of the spray was probably obtained at less than 1 gal. per acre, and a total area of 30–37 sq. miles of dense swarms was treated at a cost of approximately £13,700. There is scope for an improvement in the efficiency of the spraying technique, as well as a reduction in some of the major costs, in any future campaign.

It was considered that the campaign carried out in one of the two districts concerned completely controlled all swarms in the area and protected from invasion valuable farming lands to the south-east. Further spraying operations in a district 150 miles away were less successful, although many more locusts were killed. The spraying party arrived in the district too late to plan a strategic campaign, and some swarms escaped treatment. It is concluded that the method of aerial-drift spraying is capable of wider application in Australia, particularly in areas where problems of distance, population and lack of facilities militate against successful control by ground machinery.

Brown (E. S.). **Revision of the Genus** *Amblypelta* **Stål (Hemiptera, Coreidae).**—*Bull. ent. Res.* **49** pt. 3 pp. 509–541, 1 pl., 18 figs., 17 refs. London, 1958. **Injury to Cacao by** *Amblypelta* **Stål (Hemiptera, Coreidae) with a Summary of Food-plants of Species of this Genus.**—*T. c.* pp. 543–554, 3 pls., 18 refs.

In the revision, the characters and scope of the genus *Amblypelta* are reviewed and 12 species and five subspecies included in it, of which all but seven of the species are new. A key to them is given, followed by descriptions of the new ones, notes on the characters of those already known, and distribution records, with information on synonymy where appropriate. Those recorded on plants of economic importance are *A. nitida* Stål, injuring peaches in New South Wales and also present in Queensland; *A. lutescens lutescens* (Dist.), on banana in Queensland and also present in the Northern Territory of Australia, Banks Island and the Murray and Kai Islands; *A. l. papuensis*, subsp.n., on *Phaseolus mungo*, *Hevea brasiliensis* and cassava (*Manihot esculenta*) in New Guinea; *A. theobromae*, sp.n., on cacao, *H. brasiliensis* and cassava in New Guinea; *A. cristobalensis*, sp.n., on cassava in San Cristobal, where it was also found in a coconut plantation; *A. cocophaga cocophaga* China [*cf. R.A.E.*, A **22** 490], from Guadalcanal, Nggela, New Georgia, Rendova, Ganonga, Kolombangara and Bougainville, and *A. c. malaitensis*, subsp.n., from Malaita, both of which feed on numerous crop plants; *A. costalis costalis* Van D., on cassava and papaya in Bellona; *A. c. szentivanyi*, subsp.n., on cassava and *H. brasiliensis* in New Guinea,

on cacao in New Britain and doubtfully occurring in New Ireland; *A. c. rennellensis*, subsp.n., on papaya, cassava and other plants in Rennell Island; *A. gallegonis gallegonis* Lever, on cassava in Ysabel; and *A. g. bougainvillensis*, subsp.n., on cassava in Choiseul and cassava, sweet potato and other plants in Bougainville. The distribution of the various forms is discussed in a final note.

In the second paper, it is pointed out that two of these Coreids are now known to feed on cacao, *A. cocophaga malaitensis* in the Solomon Islands and *A. theobromae* in New Guinea. *A. c. malaitensis* was found in Malaita feeding on the pods, causing scarring and malformation, and on the terminal shoots, causing die-back of the tips, and caging experiments in Guadalcanal showed that *A. c. cocophaga* is able to cause similar damage to the pods, though it did not attack cacao naturally. *A. theobromae* also feeds on the pods. The damage caused by *Amblypelta* spp. to the fruits, stems and petioles of their food-plants is described, and a list is given showing the plants on which the various species and subspecies are known to feed. Some have a wide range, *A. lutescens* being recorded from 27 species in 18 families and *A. cocophaga* from 35 species in 23; 11 have been collected on cassava, which is not indigenous in the area, and six are associated with coconut, of which *A. cocophaga* is an important pest.

Barnes (H. F.). **Progress in the Biological Testing of Sorghum Midge (*Contarinia* spp.).**—*Bull. ent. Res.* **49** pt. 3 pp. 555–558, 4 refs. London, 1958.

Cecidomyiids indistinguishable by morphological criteria from *Contarinia sorghicola* (Coq.) have been reported attacking sorghum in many parts of the world. In investigations, infested sorghum heads were collected in Mysore State in September–October and the Northern Territories of Ghana in November–December 1955 and received at Rothamsted in the following January and February. The material was kept moist until the summer of 1956, when it was allowed to dry out, and was re-wetted in the following December. Both parasites and adult Cecidomyiids emerged, most of the former during the first period of moisture, and the latter during the second. There appeared to be no morphological differences between the Cecidomyiids and *C. sorghicola* from Texas (its type locality), but biological tests of their identity with the latter were not possible. Typical pre-mating behaviour was observed on the few occasions when newly emerged males and females from the two continents were confined together, and actual mating occurred between a male from Ghana and two females from Mysore in rapid succession. It is not known whether such inter-matings would prove fertile. Two species of parasites, *Tetrastichus* sp. (group of *T. flavovarius*, auct.) and *Eupelmus popa* Gir., were reared from the Indian material, and another species of *Tetrastichus* of the same group, but not that reared by Geering in Uganda [*R.A.E.*, A **41** 319], and *E. popa* were obtained from the material from Ghana.

Vanderplank (F. L.). **Studies on the Coconut Pest, *Pseudotheraptus wayi* Brown (Coreidae), in Zanzibar. I. A Method of assessing the Damage caused by the Insect.**—*Bull. ent. Res.* **49** pt. 3 pp. 559–584, 2 pls., 5 graphs, 11 refs. London, 1958.

The following is based on the author's summary. A method of estimating the damage to the developing fruits of coconut by *Pseudotheraptus wayi*

Brown [*cf. R.A.E.*, A **43** 170, etc.] is needed in order to assess the efficacy of measures for the control of this Coreid. The insect lives in the crown of the palm, populations are small in relation to the damage they cause, the adults take wing readily and the nymphs are agile and secretive. Direct estimation of populations by hand-collection, trapping, the use of knock-down sprays and marking-recapture methods using insects marked with paints or radioactive materials were unsuccessful, and indirect methods of estimation were therefore studied in Zanzibar.

The growth, flowering and fruiting habits of coconut are described. When an adult or late-instar nymph of *P. wayi* feeds on a developing fruiting body, a characteristic lesion develops at the site of the puncture, which is concealed by the calyx, and fruiting bodies less than three months old at the time (termed vidaka in Swahili) are normally shed 4–7 days later. As the nut develops, it becomes less likely to be shed as a result of attack, but the lesions formed may be invaded by fungi or by *Diocalandra frumenti* (F.). Fruiting bodies attacked by *D. frumenti* cease growth, but are not shed. Experiments and field observations show that where damage by *P. wayi* is prevalent, some of the vidaka are shed in the pre-fertilisation stage, even though they show no evidence of attack by the Coreid.

Fallen vidaka rot quickly and those that are found reflect damage inflicted 7–10 days previously. By collecting a sample of freshly fallen vidaka, removing the calyces and determining the percentage showing damage by *P. wayi*, a measure was obtained termed the Vidaka Damage Rate (V.D.R.). The method advocated is to collect at random and at weekly intervals a sample of at least 100 vidaka per ten acres, excluding any with an overall length exceeding 3 ins. This size is reached at about 2½ months; older fallen nutlets invariably show damage from *P. wayi* or other causes. No significant differences were found between values of the V.D.R. based on such collections and those based on collections from below individual palms, or rows of palms, taken at random. No significant difference was found between vidaka in the pre-fertilisation stage and those in the stage at which normal nutfall occurs as regards the proportion showing damage by *P. wayi*, and the former are therefore not excluded.

Comparison of the numbers of nymphs of *P. wayi* found by two trained entomologists at weekly intervals on 12 palms in each of two areas, one of which was sprayed with an insecticide at monthly intervals and the other left untreated, with the V.D.R. as determined a week later in the same area but on a larger sample of palms, showed a curvilinear association between the two quantities; the association between the logarithms of the quantities was linear, but the correlation was not quite significant. In more detailed investigations, two 100-acre areas were used, one of which was undergoing insecticidal treatment, and in each a large but variable number of palms (from 100 to over 900) was examined each week from mid-October 1956 to the end of March 1957 by trained climbers. There was less variability in the data from the control than from the treated area; the latter showed a curvilinear relation between the observed population of nymphs of *P. wayi* and the V.D.R. from the whole area one week later, but the correlation between the logarithms of the two variables was not significant.

In further examination of the data, counts of first- and second-instar nymphs, which cause little damage, were excluded, together with any week in which no individuals were recorded, and the population was expressed as the number of palms searched per nymph found, the values of the V.D.R. being computed from that part of the area in which the insects were counted. When both variables were converted to logarithms, the transformed data showed a straight-line relation with a highly significant correlation coefficient of $-0{\cdot}975$. The regression equation indicates that where the number of

palms that it would be necessary to search in order to find one nymph in the third, fourth or fifth instar is 10, 100 or 1,000, the corresponding value of the V.D.R. would be 84, 13 or 2·4, respectively. It is concluded that where the V.D.R. is below 20, the population density giving rise to such a rate of damage is so low that its accurate determination by direct counts is unlikely to be possible.

Data on V.D.R. and yield were collected from a number of experimental plots and control areas; values from the latter were too uniform to give rise to significant correlations, but when a quarterly estimate of the V.D.R. in an experimental area, obtained from the totals of damaged and of undamaged fallen vidaka collected during successive three-monthly periods, was compared with the figure for yield obtained from harvesting the same area during the corresponding quarter of the following year, a linear relation was found between yield and V.D.R., the coefficient of correlation being significant in each of the five areas considered, and ranging from $-0{\cdot}7$ to $-0{\cdot}984$, and the values of a and b in the regression equation $Y = a + bX$, where Y is the yield in nuts per palm per harvesting and X is the quarterly value of the V.D.R., ranged from 13·65 to 19·8 and from $-0{\cdot}141$ to $-0{\cdot}287$, respectively. It is concluded that the V.D.R. is a good measure of expected yield, provided that the rate does not rise unduly in the interval between assessment and harvest; in such circumstances, the increased population of *P. wayi* that is reflected in the increased V.D.R. may damage the nuts at a later stage of their development and so reduce the yield below that expected.

Yeo (D.) & Foster (R.). **Preliminary Note on a Method for the direct Estimation of Populations of** *Pseudotheraptus wayi* **Brown on Coconut Palms.**—*Bull. ent. Res.* **49** pt. 3 pp. 585–590, 4 refs. London, 1958.

The following is the authors' summary. A technique is described for counting the numbers of *Pseudotheraptus wayi* Brown on coconut palms, on which this Coreid is a serious pest in East Africa, Zanzibar and the neighbouring islands [*cf.* also last abstract]. The crown of each palm is systematically searched by an African assistant, the insects collected being classified by instars and then replaced. The adults can fly, and very few are seen or captured. Palms were examined by a team of searchers in five areas in a well-maintained plantation on Mafia Island, 3–4 separate samples, each of 61–138 palms, being taken in each area between mid-January and mid-February 1956. In all, 13 searchers participated, but not all were used on the same day; when they had become experienced, their daily catches were of comparable size. The total nymphal populations, and the proportions of them in the various stages, are sufficiently consistent to suggest that the searching technique may give reproducible results, and thus be of considerable value as a means of assessing the results of control measures. The average catch was about one nymph for each palm that was searched, and recaptures from known numbers of bugs liberated indicated that about one quarter of the population present was being found. The nymphal population is not distributed at random among the palms.

Southgate (B. J.). **Systematic Notes on Species of** *Callosobruchus* **of economic Importance.**—*Bull. ent. Res.* **49** pt. 3 pp. 591–599, 2 pls., 3 figs., 20 refs. London, 1958.

Callosobruchus chinensis (L.) (the cowpea Bruchid), which breeds throughout most of the tropics and sub-tropics, is very variable, and other species

have been confused or wrongly synonymised with it. One of these is *C. rhodesianus* (Pic) [*cf. R.A.E.*, A **25** 789], which was found by inspection of the cotype in the British Museum to be congeneric with but specifically distinct from *C. chinensis*, and by examination of cowpeas and mounted specimens to replace the latter in the southern part of Africa. It was recorded as *chinensis* on cowpeas in South Africa by Skaife [**7** 258], who was followed by other authors dealing with Bruchids on cowpeas in that country. Notes are given on various other names that have been considered, rightly or wrongly, to be synonyms of *C. chinensis* [*cf.* **45** 218], including *Bruchus marshalli* Pic [*cf.* **29** 321], which was found by comparison of cotypes to be conspecific with *C. rhodesianus*. The new name *Bruchidius thunbergi*, proposed by Southgate, Howe & Brett for *Bruchus chinensis* Thnb. (nec *Curculio chinensis* L.) [**45** 218] was unnecessary; the correct name for this species is *Bruchidius chinensis* (Thnb.). A Bruchid from the seeds of *Voandzeia subterranea* in Ghana was provisionally identified as *Bruchus vicinus* var. *subinnotatus* Pic [*cf.* also **10** 27], but as *B. vicinus* Gylh. is a synonym of *C. maculatus* (F.) [**45** 218], the status of *subinnotatus* was investigated. Examination of the type showed it to represent a distinct species in the genus *Callosobruchus*. The adults of both sexes of *C. chinensis*, *C. rhodesianus* and *C. subinnotatus* and their genitalia are described, and characters are given in tables for the differentiation of *C. chinensis* and *C. rhodesianus* and of *C. subinnotatus* and *C. maculatus*.

Simmonds (F. J.). **The Effect of Lizards on the Biological Control of Scale Insects in Bermuda.**—*Bull. ent. Res.* **49** pt. 3 pp. 601–612, 2 refs. London, 1958.

The following is based partly on the author's summary. During attempts to control *Carulaspis minima* (Targ.) (which was previously misidentified as *C. visci* (Schr.)) and *Lepidosaphes newsteadi* (Šulc) on Bermuda cedar (*Juniperus bermudiana*) in Bermuda by the introduction of some 25 species of predacious Coccinellids [*cf. R.A.E.*, A **40** 301, etc.], very few of the latter became established, though some bred readily on branches protected by sleeve cages. *Lindorus lophanthae* (Blaisd.) and *Microweisia suturalis* (Schwarz) became temporarily abundant, but both eventually diminished in population without controlling the Coccids, with the result that the trees virtually died out. The same result was obtained in an intensive study, begun in 1955, on the control of *Pseudaulacaspis pentagona* (Targ.) and *Pulvinaria psidii* Mask. on oleander (*Nerium oleander*). Several Coccinellids were successfully established, but none developed in numbers sufficient to control either Coccid. The failure of these apparently suitable predators was therefore investigated.

It seemed possible that insectivorous lizards, which are very abundant in the island, might be responsible. Dissection of a number of the lizards (*Anolis grahami* and *A. leachi*) in the autumn and winter indicated that at both these times their effect on the natural enemies of Coccids in general and of *Pseudaulacaspis pentagona* and *Pulvinaria psidii* in particular, was considerable. Both Coccinellids and Hymenopterous parasites were eaten in large numbers. A surprising number of very small insects, including ants, was eaten, and although some of the insects eaten are harmful, on balance it would appear that, particularly with regard to the biological control of Coccids, the elimination from Bermuda of these lizards, which are introduced species, would be beneficial. Experiments to test this by direct control are in progress, and the introduction of predacious birds, particularly the Trinidad kiskadee (*Pitangus sulphuratus*), is planned.

Cornwell (P. B.). **Movements of the Vectors of Virus Diseases of Cacao in Ghana. I. Canopy Movement in and between Trees.**—*Bull. ent. Res.* **49** pt. 3 pp. 613–630, 7 figs., 17 refs. London, 1958.

The mealybugs that transmit the swollen-shoot virus of cacao in Ghana may spread from infested trees by movement across the ground, by wind carriage, and by contact of canopy branches. The first method has been shown to be of little importance [*R.A.E.*, A **44** 188], and this paper, on canopy movement, is the first of two on the other two methods. The following is partly based on the author's summary of it.

An examination of the movements of *Pseudococcus njalensis* Laing, the dominant vector, showed that first-instar nymphs comprised 92 per cent. of the mobile population. Movement is initiated at about 23·5°C. [74·3°F.] and activity becomes more pronounced at higher temperatures. Movement is maximal during mid-afternoon, when many hundreds of insects become mobile on heavily infested trees. The density of mobile mealybugs increases from the base of the trunk and reaches a maximum at a few feet below the top of the canopy. Under experimental conditions, nymphs crawled at least 28 ft. in search of favourable feeding sites, and their dispersion increased proportionately with the number of canopy bridges. On cacao, adults are occasionally carried by the ant, *Crematogaster striatula* Emery. The use of insects labelled with radioactive phosphorus confirmed that *P. njalensis* is capable of crawling from tree to tree by way of the canopies of farmers' cacao. In a plantation of Amelonado cacao eight years old, 40 per cent. of the branches were in contact at a 4-ft. spacing and about 20 per cent. at spacings of 5–7½ ft. No branches were in contact where the trees were spaced more than 12 ft. apart. At the closest spacing, the ratio between the number of mobile mealybugs that reached adjacent contact trees and those that did not was about 9:100, and the ratio was reduced to 1 or 2:100 among trees growing 5–7½ ft. apart.

Since first-instar nymphs no more than 2–3 days old are efficient vectors [*cf.* **46** 210], since the distances between feeding sites are covered in periods not great enough for this efficiency to be reduced [*cf.* **43** 80], since the prevailing temperatures are unlikely to limit movement, and since the large number of mobile mealybugs involved renders the proportion that reaches adjacent trees of significance, this movement through the canopy is likely to be of importance in virus spread. In a discussion of methods of preventing it, it is stated that effective pruning is impracticable, but that use might be made, in new plantings, of wide spacing and the trees interplanted with a secondary tree crop, such as coffee, which is not susceptible to swollen-shoot and, since feeding nymphs lose their infectivity in less than an hour, might cause vectors migrating to it from diseased cacao to lose their infectivity. On the other hand, a closed canopy reduces wind spread and is important in preventing Mirid attack [*cf.* **41** 238].

Rivnay (E.). **The Biology and Control of the Cereal Leaf Miner** (*Syringopais temperatella* **Led.**) **in Israel.**—*Ktavim* (Engl. edn.) **7** no. 1 pp. 5–23, 3 graphs, 15 refs. Rehovot, 1956.

Syringopais temperatella (Led.) is an important pest of cereals in Israel. Investigations on its bionomics [*cf. R.A.E.*, A **42** 261], begun in 1949, showed that the moths emerged in early April in that year and that oviposition began 3–7 days later at temperatures of 17–18°C. [62·6–64·4°F.]. The females usually lived longer than the males and laid up to 125 eggs each in crevices in the soil. The eggs were resistant to drought, and hatched

in periods ranging from eight days at 25°C. [77°F.] to 19 days at 18°C. The newly hatched larvae aestivated in cocoons in the soil until the early rains of the following winter, moving to various depths in the soil in order to do so [*cf. loc. cit.*]. Relative humidity is probably of primary importance in this connection; in one test, about 75 and 53 per cent. of the larvae survived exposure for four days to relative humidities of 76 and over 90 per cent., respectively, whereas none survived at 32 per cent. or less. Rain in November and December was necessary for completion of the diapause and subsequent large-scale infestation. If rainfall was sufficient, the larvae left the soil in January or February and mined in the leaves of wheat or other plants for 8–9 weeks until they became full-fed during late March or early April, when they pupated in cocoons in the ground. Single wheat blades sometimes contained up to 30 or more larvae, and they sometimes attacked more than one. The pupal stage varied from one week at 24·5°C. [76·1°F.] to more than two at 18–19°C. [64·4–66·2°F.].

Spring ploughing to a depth of 10–12 ins. exposes the newly hatched larvae to low humidities and high temperatures, and is an important method of control; late sowing has also given good results, but the lowest populations were found where crops such as sesame [*Sesamum orientale*] or watermelon, which necessitate ploughing 3–5 times during spring, had been grown in the previous season. Where ploughing is difficult or ineffective, chemical control is necessary.

Field experiments in 1947 with BHC dust applied to infested soil in November showed that treatment at the rate of at least 6 lb. technical BHC per acre, immediately before ploughing and sowing, gave fair control of the larvae that emerged from diapause in late December or January. Two tests were made, 20 days apart, and the later application was much the more successful. In laboratory tests, a 5 per cent. BHC dust had a more lasting effect when buried at a depth of eight inches than at about an inch. As the degree of infestation cannot be foretold at sowing time, treatment of the growing crop in spring was tested in the field in 1949, and an application of about 26 lb. 20 per cent. BHC dust per acre in late February gave complete control; further laboratory tests confirmed the effectiveness of this treatment, 5 and 20 per cent. BHC and 20 per cent. DDT dusts resulting in about 43, 96 and 48 per cent. mortality, respectively, in 24 hours. In 1951–52, spraying the crop from aircraft with γ BHC combined with a selective herbicide (2,4-D [2,4-dichlorophenoxyacetic acid]), at the rate of 3·5 oz. γ BHC per acre, gave good control in one day, and dusting from the air with 17·6 lb. 20 per cent. technical BHC per acre was also successful. In small-plot tests, dusts of 1–5 per cent. dieldrin or 5–10 per cent. DDT gave promising results.

Avidov (Z.). **Bionomics of the Tobacco White Fly** (*Bemisia tabaci* **Gennad.**) **in Israel.**—*Ktavim* (Engl. edn.) 7 no. 1 pp. 25–41, 2 graphs, 7 refs. Rehovot, 1956.

The following is based largely on the author's introduction and summary. *Bemisia tabaci* (Gennadius) damaged vegetable crops in Israel in 1931 and 1935, and has since appeared each summer, sometimes causing severe damage. Breeding tests over several years on egg-plant (*Solanum melongena*) showed that the females lay 300 or more eggs each on the lower surfaces of the leaves. Neither eggs nor larvae are affected by air humidity, as they are attached to the leaf, but oviposition ceases and many adults die prematurely when the relative humidity averages 60 per cent. or less. Oviposition ceases when the temperature is below 14·5°C. [58·1°F.] and larval development when it falls to 12°C. [53·6°F.]. There are 11–12 generations

a year in the coastal plain and 15 in the Jordan Valley. The females live for up to about five weeks in summer and 11 in winter, and those emerging in December can survive the cold weather and oviposit at the end of it. The males have shorter lives. The rate of reproduction is greatest when temperatures are high, the number of offspring sometimes exceeding 100 per adult during May–September at an average temperature of 25°C. [77°F.], but is very low in winter at 13–14°C. [55·4–57·2°F.].

Laboratory tests showed that temperatures above 46°C. [114·8°F.] are lethal to the adults. Mulching tomato seed beds with sawdust increased the surface temperature from considerably below 46°C. to well above it during many hours of the day, and so prevented infestation, since the Aleyrodid is active only during sunny periods. This measure gave effective protection in the Jordan Valley during summer.

A list is given of 50 species of plants attacked by *B. tabaci* in Israel; solanaceous vegetables, cucurbits and leguminous forage plants are the crops most damaged. Severe infestation causes wilting, particularly in the seed bed, and the greatest damage is caused in the warm valleys of the interior. A species of *Eretmocerus*, apparently *E. masii* Silv., that occurred in the field, was found to parasitise *B. tabaci*, but little control was afforded.

YATHOM (S.). **Biology of the Spiny Boll Worm** (*Earias insulana*, **Boisd.**).—*Ktavim* (Engl. edn.) **7** no. 1 pp. 43–57, 5 graphs, 10 refs. Rehovot, 1956.

In view of the severe damage caused to cotton in Israel by *Earias insulana* (Boisd.) [*cf. R.A.E.*, A **41** 216], laboratory studies on its bionomics were undertaken in 1952–53. The results showed that at average temperatures of 26–29°C. [78·8–84·2°F.], which prevail during the cotton season (June–November) in Israel, the egg, larval and pupal stages and the preoviposition period last 3, 9–10, 8–10 and 3–6 days, respectively. There were seasonal changes in the coloration of the adults, all being green in summer, but many yellow in winter. Moderate temperatures (25–28°C. [77–82·4°F.]) were optimum for oviposition, the average number of eggs per female being about 136, as compared with 54 at 29°C. Females live rather longer than males; approximately half the moths lived for ten days or more in August at average temperatures of 28–29°C. and for 39 days in January at 14·2°C. [57·66°F.]. The generations overlap during the summer and autumn, and the period between cotton seasons is passed on species of *Hibiscus*, *Malva* and *Althaea*.

RIVNAY (E.) & YATHOM (S.). **Laboratory Tests of contact Insecticides against the Adult of the Spiny Cotton Boll Worm** (*Earias insulana* **Boisd.**).—*Ktavim* (Engl. edn.) **7** no. 1 pp. 59–62, 1 graph. Rehovot, 1956.

In experiments on the control of *Earias insulana* (Boisd.) in Israel in 1953 and 1954, twigs from cotton plants or branches of *Hibiscus mutabilis* that had been sprayed out of doors were brought into the laboratory after various periods of weathering, and adults were caged with them for 24–48 hours and provided with sugar syrup on cotton-wool as food. The results showed that sprays containing 1 per cent. of a 50 per cent. wettable DDT powder were ineffective, whereas 25 per cent. wettable dieldrin and 40 per cent. wettable toxaphene at 0·25 and 2 per cent., respectively, were effective after weathering for up to three days. In tests of contact action, a sprayed leaf that had been weathered was rolled against the inner wall of a test-tube, and five adults were confined on it for an hour and then transferred to a clean tube

and fed with sugar syrup. Counts made after 24 and 48 hours showed that 0·5 or 1 per cent. of an emulsion concentrate containing 19·5 per cent. endrin, 0·2–0·3 per cent. of another containing 46·5 per cent. parathion, 25 per cent. wettable malathion at 0·25 per cent. and 50 per cent. wettable lindane [almost pure γ BHC] at 0·25 per cent. gave good control after weathering for at least one day. Endrin was effective for five days in the emulsion but less persistent as a wettable powder at the same concentration; the other materials had less residual effect, and γ BHC was effective only one day after application. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] gave complete control initially, but soon lost its toxicity, and DDT, Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] and dieldrin were relatively ineffective.

Rivnay (E.) & Melamed (V.). **Studies on the Ecology and Phenology of *Lixus junci* in Israel.**—*Ktavim* (Engl. edn.) **7** no. 1 pp. 63–82, 9 graphs, 9 refs. Rehovot, 1956.

Lixus juncii Boh., *L. ascanii* (L.) and an unidentified species of the same genus attack beet in Israel. The first is the most important and is particularly injurious to sugar- and fodder-beets [*cf. R.A.E.*, A **41** 216]. The damage is slight if the beets are harvested by early June, but considerable if they are left longer in the field, and as fodder-beets should be left as long as possible, to supply food for the dry season, and sugar-beets must be harvested at intervals to provide a continuous supply for the factories, some must remain in the ground over the critical period.

In an attempt to find the most satisfactory times for growing sugar-beet and applying control measures, the biology of *L. juncii* was studied in the laboratory and field for three years. Overwintered adults appeared in the field in late February, were most numerous in late March and persisted until late June, and adults of the first generation emerged in late April or early May and those of the second generation in late July or early August. None of the second generation oviposited in the same season; depending on weather, some entered diapause in August and others fed and mated, but most of the latter died before winter. Oviposition by the overwintered and first generations occurred chiefly in March–April and May–August, respectively, but full-fed larvae and pupae of the latter were found as late as September. Most females of the first generation did not oviposit; in the laboratory, the remainder deposited up to 300 eggs each after preoviposition periods that fell from 2–3 weeks in April–May to 9–11 days in June, and usually ceased only shortly before death. Females apparently needed to feed on green leaf tissue in order to oviposit normally. The eggs were laid singly in the petioles, and the egg stage varied from about three days at 25–29°C. [77–84·2°F.] to over two weeks at 15°C. [59°F.]; the threshold of development was calculated to be 10·3°C. [50·54°F.], and mortality became high at temperatures above 25°C. The larvae bored in the petioles and heads of the beets and pupated in the tunnels, and as there were usually 3–8 eggs in a petiole, and sometimes as many as 20, they perforated the beet in all directions; as many as 15 larvae were found in one beet. The combined larval and pupal stages varied from about five weeks at 28°C. [82·4°F.] to 8–10 at 20–21°C. [68–69·8°F.].

Melamed (V.). **Contributions to the Biology of *Epilachna chrysomelina* in Israel.**—*Ktavim* (Engl. edn.) **7** no. 1 pp. 83–95, 7 graphs, 14 refs. Rehovot, 1956.

Laboratory tests on the development of *Epilachna chrysomelina* (F.), a pest of cucurbits in Israel [*cf. R.A.E.*, A **28** 32], showed that the duration

of the egg stage ranged from about 4 days at 29°C. [84·2°F.] to about 13 at 18°C. [64·4°F.], that of the larval stage from about 15 days at 29°C. to 26 at 22°C. [71·6°F.], and that of the pupal stage from about 6 days at 29°C. to over 20 at about 18°C. Egg mortality varied little with temperature, but larval and pupal survival was greatest at 25°C. [77°F.]. Three generations developed in the year. Adults of the first generation usually appeared in June, when the average temperature was 25°C. and those of the second and third in July–August, when it was 27–28°C. [80·5–82·4°F.]; the preoviposition periods at these temperatures lasted 5 and 13–15 days, respectively. There was no correlation between activity and oviposition, which ceased below 23°C. [73·4°F.] and above 32°C. [89·6°F.], but occurred during winter if temperatures were favourable, and counts of eggs showed that females of the first generation produced 153–1,559 each, those of the overwintered generation about half as many and those of the second and third generations only a third as many. Adults of the summer generations fed for some time and then entered hibernation, regardless of temperature, and older ones became inactive earlier than younger ones.

Moutia (L. A.). **Considérations sur le complexe biologique des lépidoptères nuisibles à l'embrevadier à Maurice.**—*Rev. agric. sucr. Maurice* **36** no. 5 pp. 256–260. Port Louis, 1957.

Pigeon pea [*Cajanus cajan*] is now little cultivated in Mauritius because of the damage caused to it by insects. *Cosmolyce* (*Lampides*) *boetica* (L.) was formerly thought to be the most important of these, but more recent investigations have shown that *Etiella zinckenella* (Treitschke), *Maruca testulalis* (Geyer), *Pardasena virgulana* (Mab.) and *Cryptophlebia williamsi* Bradley are even more injurious. *Cryptophlebia* bores in the stems, but the others infest the pods, and of these *Etiella* is the most important, constituting some 23–61 per cent. of the insects in green pods and 75–100 per cent. of those in dry ones. *Maruca* is the commonest in green pods. *Etiella*, *Maruca* and *Cosmolyce* are parasitised in the larval stage by *Bracon* (*Microbracon*) *hebetor* Say, *Etiella* also by *Chelonus* sp., *Pardasena* by an unidentified Braconid, and *Cryptophlebia* by *Goniozus* sp., *Chelonus* sp., *Xanthopimpla stemmator* (Thnb.) and *Trichospilus pupivora* Ferrière, of which the last two have been observed parasitising the pupae on *Canavalia ensiformis*. Little control is afforded, however, and in view of the food value of the crop, parasites thought likely to attack *Etiella* and *Maruca* were introduced and liberated in the field in 1953–56. Of the seven species released, *Eiphosoma* sp. near *annulatum* Cress. and *Bracon* (*Microbracon*) *cajani* Mues. [*cf. R.A.E.*, A **45** 345] were subsequently recovered.

Subba Rao (B. R.). **The Biology and Bionomics of** *Lestodryinus pyrillae* **Kieff. (Dryinidae: Hymenoptera) a nymphal Parasite of** *Pyrilla perpusilla* **Walk., and a Note on its Role in the Control of** *Pyrilla*.—*J. Bombay nat. Hist. Soc.* **54** no. 3 pp. 741–749, 1 pl., 3 refs. Bombay, 1957.

Dryinus (*Lestodryinus*) *pyrillae* (Kieff.) is an important parasite of *Pyrilla perpusilla* (Wlk.) on sugar-cane in India, and observations were made on its bionomics in the laboratory at New Delhi. Nymphs in the second, third or fourth instar were preferred for oviposition, the process of which is described, and the larva fed internally in a bag-like structure that developed between the wing-pads of the parasitised host. This burst some 20–30 days after oviposition, and the full-fed larva emerged from it and spun a cocoon on

the leaf, in which it pupated. The cocoon consisted of an outer and inner layer, completed over about three days, and the pupal stage lasted 20–30 days. Males were more numerous than females in the laboratory, but the two are about equally common in the field. The females usually lived for up to 20–30 days when sugar solution and honeydew were provided; one that survived for 38 days laid 40 eggs, but some 80–100 are probably produced in the field, where the adult parasites doubtless live for longer. Females kept without honeydew attacked the *Pyrilla* nymphs and sucked their body juices, but no such behaviour occurred when honeydew was available. No alternative host is known, and winter is passed in the pupal stage. Eggs were laid in nymphs already parasitised by *Halictophagus* (*Pyrilloxenus*) *compactus* (Pierce) but showing no external symptoms, and though development of both parasites proceeded, *Halictophagus* was killed with the host when the Dryinid larva emerged from the latter. A few of the overwintering pupae of *Dryinus* were parasitised by *Cristatithorax quadricolor* Gir., the life-cycle of which was completed in 13–15 days. All the adults of this Encyrtid were females; 6–7 emerged per female host pupa and about three per male one.

D. pyrillae is one of a sequence of parasites that attack *Pyrilla* near Delhi. The eggs are parasitised by *Tetrastichus pyrillae* Crwf., followed by *Ageniaspis pyrillae* Mani and *Cheiloneurus pyrillae* Mani, but these do not prevent numbers from increasing greatly, though parasitism by them reaches 60–70 per cent. *Dryinus* is the principal parasite of the nymphs, *Chlorodryinus pallidus* Perkins attacking them in very small numbers, and it sometimes affords 15–20 per cent. parasitism. These parasites, together with *Halictophagus*, which parasitises the adults, afford important control and keep the pest within manageable limits. It is important that this balance should not be upset by the indiscriminate use of insecticides.

Khan (N. H.) & Abedi (Z. H.). **Notes on the Biology and Control of the Lily Moth** *Brithys crini* **Fabricius.**—*J. Bombay nat. Hist. Soc.* **54** no. 3 pp. 785–788, 1 pl., 2 refs. Bombay, 1957.

Brithys crini (F.) is the most important pest of the ornamental lilies, *Crinum latifolium* and *C. asiaticum*, in India, the larvae sometimes devouring whole plants. Observations on the bionomics of this Noctuid in the laboratory at a mean temperature of 85·9°F. and relative humidity of 78·8 per cent. showed that the eggs are laid on the leaves in batches of 4–67 at the rate of up to 138 per female and hatch in 7–8 days. The larval and pupal stages averaged 31·28 and 6·68 days, respectively. In tests in which larvae were confined on leaves sprayed with various insecticides, γ BHC, DDT and DDD gave 71·4, 50 and 30 per cent. kill when emulsion concentrates containing 20, 25 and 25 per cent. toxicant, respectively, were diluted to 1:8; a dust containing 0·65 per cent. γ BHC gave 75 per cent. kill.

Inouye (H.) & Kamano (S.). **The Effects of Photoperiod and Temperature on the Induction of Diapause in the Rice Stem Borer,** *Chilo suppressalis* **Walker.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **1** no. 2 pp. 100–105, 7 refs. Tokyo, 1957. (With a Summary in English.)

In experiments on the factors inducing diapause in the rice borer, *Chilo suppressalis* (Wlk.), in Japan, second-generation larvae were reared on artificial diets and exposed to different conditions of light and temperature. Larvae from Saigoku entered diapause in the last instar when exposed to daily photoperiods of 8–14 hours, but not when the periods were 14·5–16

hours. For larvae from Shonai, the critical period of light was 14·5–15 hours. Complete darkness neither induced nor prevented diapause. Larvae kept in the dark at 20°C. [68°F.] entered diapause, but not those kept at 30°C. [86°F.]. When the larvae were reared on rice, diapause was not associated with any stage of plant growth.

Tamura (I.), Kishino (K.) & Iizima (N.). **Studies on the Bionomics of *Notiphila sekiyai* Koizumi (Ephydridae) and its Control (Preliminary Report).** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **1** no. 2 pp. 125–130, 6 figs., 1 graph, 9 refs. Tokyo, 1957. (With a Summary in English.)

Notiphila sekiyai Koizumi was observed attacking rice in the Hokuriku district of Japan in 1948 and subsequently proved to be fairly widely distributed. Investigations showed that this Ephydrid has only one generation a year. Its eggs are laid singly or in groups of up to five on the leaf sheaths, just above the water surface, and the larvae feed on the roots and overwinter in their final instar. Damage continues for 25–30 days from the time the rice is transplanted. Treatment with aldrin or dieldrin afforded good control and increased the yield.

Begg (J. A.). **Observations on the Life-history of the Eastern Field Wireworm, *Limonius agonus* (Say) (Coleoptera: Elateridae), under Laboratory Conditions.**—*87th Rep. ent. Soc. Ont. 1956* pp. 7–11, 11 refs. [Guelph, Ont.] 1957.

The bionomics of *Limonius agonus* (Say), the most injurious wireworm in the sandy soils of south-western Ontario, were investigated in the laboratory at Chatham between 1950 and 1956. Adults were collected from the soil during winter or the spring flight and stored in moist soil at 35–40°F. until required. They were then transferred to small glass dishes containing a layer of soil and exposed to the sun or artificial light at 70–80°F. to stimulate pairing and oviposition, and the eggs were separated from the soil and incubated in distilled water at 55–83°F. Newly laid eggs hatched in averages of 47·9 days at 65°F., 24·2 days at 73°F., 19·8 days at 78°F. and 18·2 days at 83°F. At 55°F., only one egg hatched out of 100, after 71 days. Viability was not affected by storage for two months in distilled water at 35–40°F. The larvae were difficult to rear, but survived in 1954 when transferred to bottles containing soil and viable seeds of timothy (*Phleum pratense*) and isolated after six weeks, after which timothy and wheat seedlings were provided as food. Diapause was apparently not obligatory, and adults were obtained in as little as a year from larvae reared continuously at 73–75°F. and from those kept in the open from October to April, the pupal stage averaging 23 days at 65°F. and 12·3 days at 83°F., but the life-cycle usually required at least 3–5 years in field-collected individuals.

Reynolds (H. T.), Fukuto (T. R.), Metcalf (R. L.) & March (R. B.). **Seed Treatment of Field Crops with Systemic Insecticides.**—*J. econ. Ent.* **50** no. 5 pp. 527–539, 1 graph, 20 refs. Menasha, Wis., 1957.

The following is based largely on the authors' summary. Tests carried out in southern California in 1954–56 showed that systemic insecticides applied to the seeds of cotton, lucerne and sugar-beet at the time of sowing protected the seedlings from attack by a wide range of insects. Studies with

radioactive Bayer 19639 (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate), Thimet (O,O-diethyl S-ethylthiomethyl phosphorodithioate) and demeton-S (O,O-diethyl S-2-(ethylthio)ethyl phosphorothioate) showed that, after seed treatment, the cotyledons contained the highest concentrations of toxicant and that this was not translocated in substantial amounts to other plant parts. The toxicant therefore existed in the plants in a considerable concentration gradient, ranging from the highest value in the oldest leaves to the lowest in the youngest. There was little difference in the absorption of the toxicant when the seeds were treated with an activated-charcoal seed coating or an emulsion or when granular formulations were placed in the seed row, and infesting the plants at various intervals after treatment showed that contents of 10 parts per million or a little less of any of the insecticides were toxic to *Myzocallis* (*Therioaphis*) *maculata* (Buckt.), on lucerne and less than 10 p.p.m. to *Tetranychus telarius* (L.) on cotton, and that Thimet was more effective than Bayer 19639 or demeton-S against *Circulifer tenellus* (Baker) on beet.

In an attempt to protect seedling lucerne from damage by *M. maculata*, systemic insecticides were tested as seed coatings and as broadcast applications of granular formulations or emulsion sprays. Demeton (diethyl 2-(ethylthio)ethyl phosphorothioate), demeton-S and Bayer 19639 were about equal in effectiveness and slightly superior to Thimet. Methyl-demeton-S (O,O-dimethyl S-2-(ethylthio)ethyl phosphorothioate) and Chipman R-6199 [hydrogen oxalate salt of O,O-diethyl S-2-(diethylamino)ethyl phosphorothioate] gave relatively poor results. When lucerne seed was coated with Thimet or Bayer 19639 on activated charcoal at the rate of 8 oz. toxicant per 25 lb. seed, good Aphid control was maintained for periods of about 4–5 and 5–6 weeks, respectively, in May–June, on rapidly growing plants; a rate of 16 oz. per 25 lb. improved the results only slightly. In October–November, when the lucerne grew slowly, Aphid control persisted for about another four weeks. Effectiveness was lost in either case when the plants attained a height of about 6 ins. Granular Thimet and Bayer 19639, broadcast at 1 lb. toxicant per acre, were as effective as seed coatings initially and rather more so after 2–3 weeks. Emulsion sprays of Thimet or Bayer 19639, applied over the sown field before the seed was covered, gave excellent results at rates of 2 and 1·5 lb. toxicant in 7 U.S. gals. spray per acre, respectively.

Several compounds were tested as seed treatments on cotton. Demeton-S, schradan and Pyrazoxon [diethyl 3-methyl-5-pyrazolyl phosphate] were relatively ineffective in greenhouse tests, and although initial work showed Am. Cyanamid 12008 and 12009 [O,O-diethyl S-isopropylthiomethyl and S-n-propylthiomethyl phosphorodithioate, respectively] to be promising, they were abandoned, as Thimet and Bayer 19639 gave somewhat better results. Coating with 1 lb. Thimet per 25 lb. seed controlled *Frankliniella* sp. and *Aphis gossypii* Glov. for about 4–5 and 5–6 weeks, respectively, and reduced populations of *Empoasca solana* DeLong by 66 per cent. six weeks after sowing and damage by flea-beetles by 76 per cent. Treatment with 0·5 lb. was nearly as effective, except against flea-beetles. Thimet also showed promise against *Trialeurodes abutilonea* (Hald.), *Liriomyza* sp., *Blapstinus* sp. and *Agrotis ypsilon* (Hfn.). Bayer 19639 was not tested against such a wide range of insects, but at the same rate as Thimet was as promising against *A. ypsilon*, slightly superior against *Aphis gossypii* and less effective against the flea-beetles. Demeton and demeton-S at 0·25 lb. per 25 lb. seed did not give satisfactory control of flea-beetles, and although greenhouse tests showed them to be promising against spider mites, these did not develop in sufficient numbers in the field for a satisfactory test.

Treating sugar-beet seed with 1 lb. Thimet per 25 lb. gave effective control of *C. tenellus* for about 2–3 weeks; reductions in populations of *Laphygma exigua* (Hb.) were variable and not promising. Bayer 19639 at the same rate and demeton at 0·25 lb. were less effective than Thimet against *C. tenellus*.

Many of the cotyledons of seedling cotton, lucerne and sugar-beet showed some scorching on the outer margins after treatment with Bayer 19639 or, particularly, Thimet. It was more pronounced at the higher rates of application, but did not appear on the true leaves. Cotton seedlings showed some reduction in size, but the difference disappeared in about 2–3 weeks. Treatment of the seed with emulsions affected the germination of cotton adversely, but activated-charcoal formulations had no marked effect, though it tended to reduce the rate of seed flow through the planter. When soil moisture was adequate, sugar-beet and lucerne stands were not reduced by treatment.

The germination of soy-bean seed was almost completely prevented and that of sorghum greatly impaired by coating with 1 lb. Thimet or Bayer 19639 per 25 lb.; Bayer 19639 was less harmful than Thimet, and granular formulations at 1 lb. toxicant per acre were safer than seed coatings. None of the treatments appeared to reduce infestation by *Elasmopalpus lignosellus* (Zell.). Studies on lucerne treated with Thimet or Bayer 19639 at sowing time showed that toxic residues disappeared in about 6–8 weeks, regardless of the method of application, and had gone by the time the plants reached a height of about 6 ins., whatever the rate of plant growth. There was, therefore, no residue problem by the time of the first cutting or pasturing.

Burkhardt (C. C.). **Corn Earworm Control in Grain Sorghum.**—*J. econ. Ent.* **50** no. 5 pp. 539–541, 3 refs. Menasha, Wis., 1957.

The following is based on the author's summary. *Heliothis zea* (Boddie) is one of the most important insect pests of grain sorghum in Kansas, causing reductions in yield and in germination by feeding on the heads, all of which have been found to be infested in some fields, sometimes with as many as 16 larvae each. Rapid control is essential, owing to the voracious feeding of the insects, and tests were carried out near Manhattan during August and September 1956 with emulsifiable concentrates of various insecticides, applied in sprays from aeroplanes or ground machines.

Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] consistently gave the quickest and highest kill, at 0·375 or 0·5 lb. per acre, but was less satisfactory at 0·25 lb. DDT gave good control at 1·5–2·5 lb. per acre, but is not recommended, except for seed production, because of the danger of toxic residues. Endrin, Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate], heptachlor, parathion, malathion and a mixture of DDT and toxaphene gave fair control, and methoxy-DDT (methoxychlor) was ineffective. Aerial applications gave somewhat slower kill than ground treatment.

O'Dell (W. V.). **Status of the cooperative Gypsy Moth Program September 30, 1956.**—*J. econ. Ent.* **50** no. 5 pp. 541–543. Menasha, Wis., 1957.

After the serious outbreak of *Lymantria* (*Porthetria*) *dispar* (L.) in the forests of the north-eastern United States in 1953 [*cf. R.A.E.*, A **44** 164],

further considerable increases in the area infested were feared, and large-scale trapping surveys in the summers of 1954 and 1955 showed an unprecedented spread of the insect, as a result of which ten million acres of additional territory were brought under quarantine regulation [*cf.* **45** 155]. As a large-scale operation for the control of an outbreak in Michigan, begun in 1954 [*cf.* **44** 119], had been so successful in three seasons that early eradication was anticipated, an accelerated control and survey programme was begun in 1956. This aimed initially at eradicating the moth from areas newly infested since 1953 and preventing reinfestation of these, and finally at eradicating it altogether. More than 941,000 acres in New York, New Jersey, Pennsylvania, Michigan and New England were sprayed by aeroplane with 1 lb. DDT in 1 U.S. gal. spray per acre, and nearly 25,000 traps were used to survey about ten million acres. These revealed some extension of infestation in central New York, northern New England, Pennsylvania and New Jersey, but outbreaks were light and generally scattered. No moths were trapped in Ohio, Indiana, Virginia or West Virginia. Epidemic conditions were found at scattered localities along the border between New York and New England, but high larval mortality, due to polyhedral virus disease, in the summer of 1955 had reduced populations in much of eastern New England. Infestations were light in much of the recently quarantined area, where general continuous infestation and the rapid development of high populations was evident only in the Hudson Valley. Further large-scale operations planned for 1957 are described.

Douglass (J. R.), Ingram (J. W.), Gibson (K. E.) & Peay (W. E.). **The Western Bean Cutworm as a Pest of Corn in Idaho.**—*J. econ. Ent.* **50** no. 5 pp. 543–545, 2 figs., 4 refs. Menasha, Wis., 1957.

Loxagrotis albicosta (Sm.), which feeds on the foliage, stems, buds, seeds or fruits of various plants, was found attacking maize near Tuttle, Idaho, in August 1954. The larvae overwintered when full-fed, in cells at depths of 3–11 ins. in the soil, and pupated in late spring or early summer, and the adults emerged in July or early August [*cf. R.A.E.*, A **37** 470]; moist soil was apparently essential for emergence from the deeper levels. In observations in 1956, 86 females had preoviposition and oviposition periods of 1–5 and 2–13 days, respectively, and laid 84–627 eggs each. The eggs hatched in 5–7 days, and the five larval instars lasted for averages of 4–5 days each, but there was considerable overlapping of instars among larvae from one egg-mass. The eggs were laid and the larvae fed on all the aerial parts of the plant, and injury, which is described, was caused from 21st July to 3rd October. A survey on 3rd–17th August 1955 showed that six of 37 fields of dent maize and one of 18 of sweet maize were infested, and another between 2nd August and 26th September 1956 that 23 of 37 fields of dent maize and 30 of 49 of sweet maize were infested. In south-central Idaho, killing frosts may occur as late as 14th July and as early as 31st August, so that it is unlikely that sowing can be timed to avoid injury to the crop by this cutworm; some of the maize is cut for ensilage before the larvae enter the soil to overwinter, and this partly reduces the population.

Lichtenstein (E. P.). **DDT Accumulation in mid-western Orchard and Crop Soils treated since 1945.**—*J. econ. Ent.* **50** no. 5 pp. 545–547, 7 refs. Menasha, Wis., 1957.

In view of reports of the accumulation of DDT in the soil of orchards and fields in the United States [*cf. R.A.E.*, A **43** 211; **45** 408] and of the possible influence of its breakdown products on crops, a survey was made

in the autumn of 1955 of the amounts accumulated in soils of mid-western orchards and crop fields that had been treated with DDT for insect control in one or more years since 1945. Soil samples were analysed for DDT by the Schechter-Haller method. Those from apple orchards contained 93·5–106 parts per million in Indiana, 38·6 p.p.m. in Ohio, 36·6 p.p.m. in Missouri and 1·5–38·3 p.p.m. in Michigan, and those from peach orchards in Michigan contained 9·4–17·3 p.p.m. In fields in which vegetable and other crops had been grown, 0·53–0·9 p.p.m. was recovered in Wisconsin, 0·56–1 p.p.m. in Iowa, 0·6–4·6 p.p.m. in Illinois, 0–0·55 p.p.m. in North Dakota and 0·49 p.p.m. in Missouri. There was no relation between the amount of DDT found in the soils and the various crops grown. Turf plots in Ohio that had been treated with DDT at 12·5–37·5 lb. per acre in 1945 contained 10·9–17·9 per cent. of the amount applied, when sampled in 1955.

Moore (A. D.). **The relative Toxicity of DDT, Toxaphene, Lindane and Isodrin to** *Dendroctonus brevicomis* **Lec. and** *Ips confusus* **(Lec.).**—*J. econ. Ent.* **50** no. 5 pp. 548–550, 2 graphs, 3 refs. Menasha, Wis., 1957.

As burning infested trees or treating them with a penetrating oil spray, which are the methods at present in use for suppressing outbreaks of bark-beetles in forests in the western United States, have practical limitations, investigations were begun on the toxicity to the beetles of insecticides that could be applied to the surface of the bark so as to leave deposits that would kill emerging beetles or prevent attacks on uninfested trees. Adults of *Dendroctonus brevicomis* Lec. and *Ips confusus* (Lec.) reared in the laboratory from field-collected ponderosa pine [*Pinus ponderosa*] were treated topically with various concentrations of insecticide in acetone solution and examined for mortality after 72 hours. Tests with adults less than 12 hours after emergence showed that the LD50's in μg. per mg. body weight for *D. brevicomis* and (in brackets) *I. confusus* were 0·095 (0·024) for pure p,p'DDT, 0·428 (0·049) for technical toxaphene, 0·034 (0·002) for lindane (99 per cent. γ BHC) and 0·019 (0·008) for 91 per cent. isodrin. The corresponding LD90's were 0·682 (0·093), 4·303 (0·255), 0·182 (0·009) and 0·054 (0·017), respectively.

Hall (I. M.). **Use of a Polyhedrosis Virus to control the Cabbage Looper on Lettuce in California.**—*J. econ. Ent.* **50** no. 5 pp. 551–553, 1 graph, 7 refs. Menasha, Wis., 1957.

A polyhedral virus disease sometimes gives effective control of outbreaks of *Trichoplusia ni* (Hb.) on cotton in summer in the south-western United States and also attacks it on cruciferous crops in many other parts of the country [*cf. R.A.E.*, A **45** 278]. It has not been recorded from populations on lettuce, however, and its potential value on this crop was therefore tested in California, where the larvae are important pests of autumn-grown lettuces in the desert valleys.

Laboratory tests in which the larvae were fed with plant material dipped in suspensions of the polyhedra and kept at a temperature of 72°F. showed that individuals in the first two instars succumbed more rapidly than those in the fourth or fifth, although mortalities were about equal after nine days, when concentrations of a million or more polyhedra per ml. gave practically complete mortality and 100,000 per ml. about 85 per cent.; the lowest dose caused no mortality of the older larvae for the first seven days. Temperature affected the activity of the virus considerably, a suspension containing

ten million polyhedra per ml. requiring 19 and 45 days for complete mortality at temperatures of 15·5 and 10°C. [59·9 and 50°F.], respectively.

In a field test in October–November 1953, in which suspensions were applied from a hand sprayer with a single overhead nozzle to newly thinned lettuce in the Imperial Valley during warm weather, 150 U.S. gals. per acre of suspensions containing 1–6 hundred thousand polyhedra per ml. killed many larvae in 6–9 days; applications of 37·5 or 75 U.S. gals. suspension per acre at a concentration of 300,000 per ml. to half-grown lettuce during a period of cool weather resulted in about 80 per cent. mortality in 25 days. In November 1954, in cool weather, sprays containing 1, 5 or 10 million polyhedra per ml. were applied at the rate of 12 U.S. gals. per acre to half-grown lettuce, either once or twice at an interval of two weeks. Counts of the percentages of plants infested with larvae in the third–fifth instars, made during the next 45 days, indicated that high dosages of the virus were more effective than low ones in reducing larval populations and that two applications were more effective than one of the same concentration and at least as effective as one of a higher concentration; one application of the highest dosage resulted in almost complete mortality of older larvae. As applications were made with a single nozzle above the row, little infective material reached the lower sides of the outer leaves, where the eggs and newly hatched larvae occur; future tests with side nozzles should result in increased mortality of the younger larvae and thus prevent serious damage.

Blackburn (N. D.). **Effects of some insecticidal Materials on larval Populations of the Alfalfa Weevil in southern Pennsylvania.**—*J. econ. Ent.* **50** no. 5 pp. 559–562, 1 fig., 5 refs. Menasha, Wis., 1957.

Hypera variabilis (Hbst.) (*postica* (Gylh.)), which was first reported in Pennsylvania in 1952 [*cf. R.A.E.*, A **41** 283], spread rapidly and is becoming an important pest of lucerne in the south-eastern counties of that State, defoliating the first crop and sometimes retarding the second or even killing the plants. Counts were made in 1956 of the larval populations that developed and survived on first-crop lucerne treated with various insecticides. Larvae were first observed in the field on 4th May, caused noticeable foliage injury by 11th May and reached maximum numbers by 5th June. Treatment with 4–8 oz. endrin or dieldrin, 6–12 oz. heptachlor, 4 oz. lindane [almost pure γ BHC] or a mixture of 3 oz. each of heptachlor and γ BHC in 100 U.S. gals. emulsion spray per acre on 27th April reduced populations significantly by 18th May; numbers had risen again a week later, but, except in the plot sprayed with γ BHC alone, remained lower than those in untreated plots throughout the experiment. Heptachlor in 2·5 per cent. granules, broadcast by hand at 44 lb. active compound per acre, kept numbers extremely low throughout the test period and protected the crop until it was harvested 53 days later. In later spray applications, 4 oz. dieldrin, 6 oz. heptachlor and the mixed spray were as effective when applied on 4th May as on the earlier date, and applications of 6 oz. heptachlor on 11th or 18th May also caused high initial mortality, but were too late to protect the crop from damage. It is concluded that larval populations can be effectively controlled, at least in some years, by the early application of suitable insecticides.

Anthon (E. W.). **Control of the Plum Nursery Mite on Sweet Cherries.** —*J. econ. Ent.* **50** no. 5 pp. 564–566, 2 refs. Menasha, Wis., 1957.

Sprays of parathion gave good control of *Vasates fockeui* (Nal. & Trt.) on sweet cherry in north-central Washington until 1954, when this and other

organic phosphorus acaricides proved less satisfactory. The mite became increasingly injurious in 1954–56. In experiments on control, various sprays were applied after harvest, on 14th July 1954 and 18th–23rd August 1955, and weekly counts of mites on the leaves showed that 1 U.S. pint 21·2 per cent. emulsifiable demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] per 100 U.S. gals. and 1 lb. 25 per cent. wettable parathion with 2 lb. 18·5 per cent. wettable Kelthane [1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol], 4 lb. 85 per cent. wettable sulphur, or 1 U.S. pint 50 per cent. emulsifiable Hercules AC-528 [2,3-p-dioxandithiol S,S-bis(O,O-diethyl phosphorodithioate)] per 100 U.S. gals. gave very good reductions in population for four weeks; demeton was rather slow in taking effect. In other tests, the application of 50 lb. of a dust containing 1 per cent. TEPP [tetraethyl pyrophosphate] and 4 per cent. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] per acre by aeroplane before harvest was effective in several orchards in 1954, and sprays of 2 lb. Aramite, 3 lb. wettable sulphur, 1·5 lb. Kelthane or chlorobenzilate [ethyl 4,4′-dichlorobenzilate], 1 lb. AC-528 or 1 U.S. pint Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate] per 100 U.S. gals. on 26th May 1956 all gave good control for a month. Cherries sprayed with wettable sulphur, Aramite, Kelthane or chlorobenzilate on 11th–28th May showed little visible residue three weeks after application and less at harvest in the last week of June.

Elmer (H. S.) & Jeppson (L. R.). **Biology and Control of the Citrus Flat Mite.**—*J. econ. Ent.* **50** no. 5 pp. 566–570, 2 figs., 5 refs. Menasha, Wis., 1957.

Since it was first discovered on lemon in California in 1944, *Brevipalpus lewisi* McG. has been observed on orange, grapefruit, tangerine, pomegranate and walnut in California [*cf. R.A.E.*, A **45** 406] and vines in Arizona. It was rare in central California until 1952, since when it has increased in importance throughout the *Citrus*-growing areas; injury has been less extensive but equally severe in many groves in southern California. The mite occurs mainly at the stem end of the fruit, preferring green to ripe fruits and fruits of any age to leaves or twigs, and populations are greatly reduced by fruit-picking. The damage results in a lowering of the grade of the fruit. The eggs are deposited singly in crevices on fruits, twigs or leaves. In southern California, all stages occur throughout the year, but in central California, probably only the adult overwinters. Populations are highest during the warmer months and are not reduced by periods of high temperature with low humidity.

B. lewisi is best controlled with sulphur, applied during late winter and early summer; dusting with 75 lb. sulphur per acre or thorough spraying with 4–6 lb. wettable sulphur per 100 U.S. gals. gave satisfactory control for the season in 1952, but as sulphur cannot be applied before or during hot weather or within 60 days of an oil-emulsion spray, other acaricides were tested. Experiments in 1955–56 and observations in commercial orchards showed that the organic phosphorus compounds did not reduce populations below injurious levels [*cf.* **46** 225], whereas fruits on trees sprayed with 8–12 oz. 18·5 per cent. wettable Kelthane [1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol] or 2·5 U.S. pints 20 per cent. emulsifiable chlorbenside [p-chlorobenzyl p-chlorophenyl sulphide] per 100 U.S. gals. water in November 1955 were free from infestation in the following June, and those on trees sprayed with 6·75 U.S. pints emulsifiable Kelthane or 10 U.S. pints 25 per cent. emulsifiable chlorobenzilate [ethyl 4,4′-dichlorobenzilate] in 250 U.S. gals. spray per acre in May 1956 were uninfested in November [*cf.* **44** 234].

Walstrom (R. J.) & Lofgren (J. A.). **Granulated Insecticides for the Control of the Alfalfa Weevil.**—*J. econ. Ent.* **50** no. 5 pp. 574–575, 7 refs. Menasha, Wis., 1957.

Counts of larvae of *Hypera variabilis* (Hbst.) (*postica* (Gylh.)) on lucerne at the first cutting on 11th June 1956 in two districts in western South Dakota showed that applications of 0·25 or 0·5 lb. heptachlor or dieldrin per acre in granules on 16th March, when there was 1–2 inches of snow on the ground and the temperature was 27°F., or on 13th April, when plant growth averaged one inch in height, gave highly significant reductions in the numbers of larvae, as compared with no treatment, and were as effective as 0·25 lb. heptachlor or dieldrin per acre in emulsion sprays applied on 14th or 17th April. There were no significant differences in control except between the two dosages of heptachlor in granules in one locality.

Wene (G. P.). **Cabbage Aphid Control.**—*J. econ. Ent.* **50** no. 5 pp. 576–577, 2 refs. Menasha, Wis., 1957.

In further tests on cabbage at Weslaco, Texas, of sprays and dusts applied against *Brevicoryne brassicae* (L.) [*cf. R.A.E.*, A **40** 177], which may require control measures from mid-January, treatment with 0·5 lb. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] in 5 U.S. gals. spray per acre effectively reduced populations for three weeks, but only 57 and 42 per cent. of the plants were free from the Aphid after two and three weeks, respectively. Similar treatment with 0·25 lb. demeton, 0·25 or 0·5 lb. Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] or 1·2 lb. malathion gave effective control for four days, after which Phosdrin lost effectiveness the most rapidly; nine days after treatment, second applications of all materials were necessary, and these were more effective than the first, indicating the importance of repeated applications at suitable intervals. A single spray of 0·5 lb. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] per acre was not commercially adequate. Spraying with 1·2 lb. malathion, 0·5 lb. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] or 0·4 lb. endrin and dusting with 25 lb. 4 per cent. diazinon, 5 per cent. malathion or 1·5 per cent. endrin per acre gave good control, and spraying with 0·25 lb. Dow ET-14 [O,O-dimethyl O-2,4,5-trichlorophenyl phosphorothioate] or 0·5 lb. Sevin (1-naphthyl N-methylcarbamate) promising control, whereas sprays and dusts of pyrethrum with piperonyl butoxide and sprays of Hercules AC-528 [2,3-p-dioxandithiol S,S-bis(O,O-diethyl phosphorodithioate)] and Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] were ineffective.

In a test on brussels sprouts, 7·5 per cent. malathion and 2 per cent. Phosdrin in dusts were effective, with little improvement in control when the rate of application was increased from 25 to 35 lb. per acre.

Shirck (F. H.). **Experiments for the Control of the Onion Maggot.**—*J. econ. Ent.* **50** no. 5 pp. 577–580, 1 fig., 1 ref. Menasha, Wis., 1957.

Investigations on the control of *Hylemyia antiqua* (Mg.) on onion were carried out in southern Idaho in 1951–54, on bulb crops grown from seed and seed crops grown from overwintered bulbs.

Drenching the soil, as the seed was sown, with 25 U.S. gals. liquid containing 1 lb. heptachlor, toxaphene, aldrin, chlordane, DDT or dieldrin

or 0·5 lb. lindane [almost pure γ BHC] per acre in emulsion form in 1951 and 0·5 lb. heptachlor, dieldrin or aldrin or 1 lb. chlordane in wettable powders in 1952 increased the stand of bulb onions, heptachlor doing so the most. In 1952, coating the seeds with 0·25 lb. wettable aldrin, dieldrin or heptachlor per 100 lb. seed, with the addition of a fungicide and methyl cellulose, also gave good protection. Dieldrin and heptachlor were less effective as seed coatings than as drenches, possibly because the doses were much lower, but the seed coatings were easier to apply. In 1953, coatings of 0·5–4 lb. wettable aldrin, dieldrin or heptachlor were all effective, with no significant difference between dosages; the higher doses of aldrin in this test and the drenches and seed coatings of γ BHC all affected plant growth. In 1954, when insecticides were broadcast in soil at 3 lb. toxicant per acre and harrowed in, aldrin and heptachlor gave significant protection, whereas dieldrin and chlordane did not.

In tests on seed crops, traps coated with adhesive were used to detect the time of adult emergence, which usually began in late April and reached a maximum in late June. In 1952, when sprays were applied at 25 U.S. gals. per acre to the base of the plants and a strip of soil 6 ins. wide along the rows on 22nd May and 16th and 21st June, 1 lb. dieldrin, heptachlor, DDT or aldrin and 0·5 lb. γ BHC per acre all caused significant increases in yield of seed, and in 1953–54, soaking the bulbs for ten minutes in 0·75 lb. emulsifiable chlordane, heptachlor or aldrin per 50 U.S. gals., dipping them for 5 seconds in the chlordane emulsion, or applying 3 lb. aldrin per acre, mixed with soil, to a five-inch strip of soil along the furrow before the bulbs were set likewise caused significant increases.

Wallis (R. C.). **Incidence of Polyhedrosis of Gypsy-moth Larvae and the Influence of Relative Humidity.**—*J. econ. Ent.* **50** no. 5 pp. 580–583, 1 graph, 28 refs. Menasha, Wis., 1957.

A polyhedral virus disease sometimes affords high mortality of late-instar larvae of *Lymantria* (*Porthetria*) *dispar* (L.) in the north-eastern United States, but it has been little investigated and recent attempts to initiate an epizootic by spraying infested woodland with a suspension of the polyhedra were unsuccessful. The incidence of the disease was studied in Connecticut in 1953–56, during which time it appeared in 538 colonies of larvae from individual egg masses that were collected in ten geographically separated localities differing widely in ecological conditions. In laboratory tests, hydroxylamine or potassium nitrite (which have been found to act as chemical stressors increasing the mortality of silkworms [*Bombyx mori* (L.)] due to virus disease) were administered to larvae in their food, but resulted in only slight increases in the incidence of polyhedrosis. During field studies of an epizootic at Bethany, Connecticut, in 1956 and concurrent laboratory observations on larval populations, little polyhedrosis was observed in a two-week period of low relative humidity, but incidence increased when the humidity rose sharply.

Frick (K. E.). **Further biological Studies on the Western Cherry Fruit Fly.**—*J. econ. Ent.* **50** no. 5 pp. 584–587, 1 fig., 4 refs. Menasha, Wis., 1957.

Examination of larvae of *Rhagoletis cingulata* (Lw.) from six populations on wild and cultivated cherries in the Yakima Valley of central Washington

showed that all belonged to the western subspecies, *R. c. indifferens* Curr. [*cf. R.A.E.*, A **45** 153].

In biological studies, pupae that had been kept at 35°F. for 6–7 months withstood exposure to 8° for one hour if the low temperature was reached gradually over a period of 24 hours, but were all killed by exposure to −20° for several hours. Refrigerating the pupae at 32–40° for 6–7 months terminated the diapause [*cf.* **45** 152] and resulted in 86 per cent. adult emergence in 60 days when the pupae were subsequently kept at 80°, whereas refrigerating them for 15–17 months resulted in 65 and 92 per cent. pupal mortality over 1–8 and 46 days, respectively, at 80°, and in 88 per cent. over 46 days at 70°F. When the pupae were kept at constant temperatures for 45 days, none developed at 50°, whereas 33 and 86·5 per cent. began to develop at 60 and 70° and 92 and 21·5 per cent. transformed to adults at 80 and 90°F. The highest temperature was detrimental, 51·5 per cent. of the pupae being killed by it and 25 per cent. failing to develop, and resulted in 62 per cent. deformed adults. Transferring pupae after 1–7 weeks from 80 to 90° and from 90 to 80°F. showed that the longer the period at the higher temperature, the greater the pupal mortality.

Infestations of 1–85 larvae per 100 cherries were found in an unsprayed orchard in 1949–56, the weather being the most important factor affecting the degree of infestation; when early-season temperatures were high, the adults emerged rapidly and infestation was heavy, and this was confirmed in laboratory tests, in which the actual air temperatures for one of the warmest and one of the coolest seasons were reproduced. When adults were kept at 90°F., relative humidities of 50–60 per cent. reduced the survival period and oviposition to some extent and humidities above 75 per cent. greatly reduced both.

Rodriguez (J. G.), Chen (H. H.) & Smith jr. (W. T.). **Effects of Soil Insecticides on Beans, Soybeans, and Cotton and resulting Effect on Mite Nutrition.**—*J. econ. Ent.* **50** no. 5 pp. 587–593, 9 graphs, 24 refs. Menasha, Wis., 1957.

The following is based on the authors' summary. The effects of soil applications of DDT, BHC, lindane [almost pure γ BHC], aldrin, dieldrin and chlordane on the weight and the composition of the leaves of Black Valentine beans, soy beans and cotton were investigated by growing the plants in pots in the greenhouse, and their nitrogen, phosphorus and potassium contents were compared with the populations of *Tetranychus telarius* (L.) and (on cotton only) *T. tumidus* Banks that developed on them [*cf. R.A.E.*, A **42** 166]. Mite development was measured by counting the progeny produced by five adult females on detached leaf disks.

On soy beans, DDT depressed mite development slightly at 5–20 lb. per acre and the nitrogen content at 80–160 lb., and stimulated plant growth at 10 lb. per acre. BHC decreased the mite populations and potassium content sharply and led to increases in nitrogen and phosphorus at 80 lb. per acre or more, and the correlations between mite numbers and the contents of these elements were significant; γ BHC had similar but less significant effects. Low dosages of BHC stimulated plant growth and high ones depressed it; only the latter effect was noted with γ BHC. Aldrin, dieldrin and chlordane had similar effects on the elements, resulting in slight increases in nitrogen content at 20–160 lb. per acre, and a slight depression in mite development, though the latter was significant only for chlordane. Stimulation of plant growth was noted in most tests at the lower rates.

On beans, DDT decreased the nitrogen and phosphorus contents at 5–100 lb. per acre, but increased them at higher rates. Potassium content

and mite populations decreased at all levels and were generally positively correlated with each other. There was little or no stimulation of plant growth at low dosages, and phytotoxic effects at moderate ones. BHC affected the leaf composition strikingly and γ BHC less so; mite development was increased by BHC at 160 lb. per acre and quite sharply by γ BHC at 20–160 lb., being correlated negatively with nitrogen and phosphorus contents and positively with potassium. Aldrin and dieldrin depressed the nitrogen and phosphorus contents slightly and increased mite production; they appeared to cause elongation of the stems at the lower rates. Chlordane caused a typical reaction, in that the nitrogen content increased and the mites decreased at application rates of up to 160 lb. per acre, after which the curves reversed directions.

On cotton, DDT had little effect on plant growth, the development of *T. tumidus* or absorption of the elements other than phosphorus, which was decreased by all levels of DDT. BHC again influenced plant composition to a greater degree than the other insecticides, though its effect on phosphorus content was erratic. Nitrogen was decreased and plant growth stimulated by low rates, but this was reversed at higher ones. *T. telarius* and *T. tumidus* varied in their reactions, only the former showing increased development at low dosages of BHC. Aldrin decreased the contents of nitrogen slightly and phosphorus considerably; and also decreased the numbers of *T. tumidus*, which were positively correlated with absorbed phosphorus. Effects on plant growth were slight.

Cressman (A. W.). **Light Oil with Parathion or Malathion for Control of Black Scale on Oranges.**—*J. econ. Ent.* **50** no. 5 pp. 593–595, 7 refs. Menasha, Wis., 1957.

Although *Aphycus* (*Metaphycus*) *helvolus* Comp. affords good control of *Saissetia oleae* (Bern.) on *Citrus* in California [*cf. R.A.E.*, A **31** 245; **42** 264], an outbreak of the Coccid followed the cold winter of 1949–50 and parasitism is much less effective in the interior of the State, where the pest has only one generation a year, than in the coastal districts, where it has several overlapping generations. Sprays of light-medium oil emulsion control this and other *Citrus* pests but tend to impair navel oranges, and to increase the incidence of water spot, which sometimes occurs after wet weather in winter. In 1953–55, a special light oil (viscosity 50–55 secs. Saybolt at 100°F., 90 per cent. minimum unsulphonatable residue and 82 per cent. minimum distillation at 636°F.), with parathion or malathion, was tested. A single application on 18th March 1953 of 1 U.S. gal. of an oil with 0·12 lb. parathion per 100 U.S. gals. emulsion spray gave promising control in a preliminary test in a single-brooded area, and one on 21st August 1953 of 1 U.S. gal. of the oil with 0·12 or 0·25 lb. parathion per 100 U.S. gals. or of 1·75 per cent. light-medium oil emulsion, made by hand to Valencia oranges, in a double-brooded area, caused heavy immediate scale mortality and was still effective in July 1954, with no significant differences between treatments; the light-medium oil was the best against *Panonychus* (*Metatetranychus*) *citri* (McG.), but all controlled a light infestation. Similar results were obtained with applications of 1 U.S. gal. light oil with 0·15 lb. parathion or 0·25 lb. malathion or of 1·8 U.S. gals. light-medium oil with 0·25 lb. malathion per 100 U.S. gals., made by oscillating boom to heavily infested navel oranges in a single-brooded area on 22nd August 1955. A light infestation of *Aonidiella aurantii* (Mask.) was satisfactorily controlled, and the light-oil sprays had little effect on the appearance of the fruits or the incidence of water spot, which became common on the navel oranges sprayed with the light-medium oil.

Guyer (G. E.), Reath (N.) & Haisley (K.). **The Biology and Control of the Maggot Complex associated with Spinach.**—*J. econ. Ent.* **50** no. 5 pp. 595–598, 1 fig., 5 refs. Menasha, Wis., 1957.

The presence of maggots in the expanding buds of spinach at harvest, resulting in contamination of the canned product with insect parts, is a problem in parts of the United States, and investigations were therefore carried out in Michigan in 1954–56. Infested spinach was collected, and 11 species of Diptera in six families were reared from it; 71 per cent. of the insects were *Scaptomyza graminum* (Fall.), and *Hylemyia cilicrura* (Rond.), *Muscina stabulans* (Fall.) and *M. assimilis* (Fall.) comprised 10, 7 and 10 per cent., respectively.

When applied to the foliage four times in May and early June in 1954 or 1955, sprays of DDT, lindane [almost pure γ BHC], malathion, parathion, dieldrin, diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] and Dow ET-14 [O,O-dimethyl O-2,4,5-trichlorophenyl phosphorothioate] gave significant but not commercial control, and 0·75 lb. malathion per acre in 10 per cent. granules was more promising. In 1956, applications of 0·5 lb. dieldrin, heptachlor or parathion per acre in granules on 19th and 21st June gave 99, 90 and 89 per cent. protection, respectively. Malathion in granules and dieldrin, parathion and Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] in emulsion sprays were less effective, but gave significant control. Other phosphorus compounds were ineffective and, in general throughout the experiments, the chlorinated hydrocarbons were superior to the organic phosphates. Treatment of the soil with 5 lb. dieldrin or heptachlor per acre in an emulsion spray on 15th April 1955, before sowing, gave significant but inadequate control.

Residues on spinach samples picked seven days after the last of 4–5 spray applications were below the legal tolerances for all insecticides for which these have been established, except dieldrin, on fresh spinach and for all on the canned product. In 1956, residues of dieldrin on samples taken from 30 minutes to four days after treatment were generally 3–4 times as high on sprayed plants as on those treated with granules. Only dieldrin left a detectable residue on plants grown in treated soil.

It is concluded that dieldrin and parathion in granules are the most promising of the materials tested.

Rings (R. W.). **Types of seasonal Incidence of Stink Bug Injury to Peaches.**—*J. econ. Ent.* **50** no. 5 pp. 599–604, 3 figs., 15 refs. Menasha, Wis., 1957.

The following is based on the author's summary. Cage tests carried out in Ohio in 1953–56 with various Pentatomids showed that they caused five types of injury to peach, referred to as blossom or fruit drop and cat-facing or deformation [*cf. R.A.E.*, A **44** 241], scarring, gummosis and a condition resembling water-soaking of the fruits. *Euschistus servus* (Say) and *E. variolarius* (P. de B.) produced all five types. *E. tristigmus* (Say), *Acrosternum hilare* (Say), *Holcostethus limbolarius* (Stål) and *Thyanta custator* (F.) caused cat-facing, and the first also scarring, and *Brochymena quadripustulata* (F.) and *Banasa dimidiata* (Say) caused gummosis.

Studies of the injury caused by *A. hilare*, *T. custator* and the three species of *Euschistus* from bloom until harvest showed that the fruits responded differently to insect feeding at different stages of development. Cat-facing was produced from bloom to 49 days later, and scarring, which is considered to be a mild form of cat-facing without deformation, gummosis,

which was the most prevalent type of injury, and the water-soaked condition 42–56, 42–115 and 45–119 days after bloom, respectively.

Vanderzant (E. S.), Kerur (D.) & Reiser (R.). **The Role of dietary Fatty Acids in the Development of the Pink Bollworm.**—*J. econ. Ent.* **50** no. 5 pp. 606–608, 14 refs. Menasha, Wis., 1957.

An account is given of experiments carried out to find the effect of various fatty acids and natural fats on the growth and development of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.), using a synthetic casein medium similar to that previously developed [*cf. R.A.E.*, A **45** 346]. The results showed that the omission of maize oil from the medium resulted in failure of the adults to emerge from the pupal cases, but that it could be replaced by linoleic acid (supplied as the urea adduct to avoid rancidity) or, better still, by linolenic acid (pure, or as linseed oil). In tests with these and other lipides, emergence appeared to increase with the amount of unsaturation.

Brazzel (J. R.) & Gaines (J. C.). **Cotton Yield and Quality Losses caused by various Levels of Pink Bollworm Infestations.**—*J. econ. Ent.* **50** no. 5 pp. 609–613, 2 graphs, 3 refs. Menasha, Wis., 1957.

The following is based on the authors' summary. In continuation of work already noticed [*R.A.E.*, A **46** 57], large-cage experiments were carried out in Texas in the autumn of 1955, when cold weather delayed maturity, and the spring of 1956 to determine the effect on the yield and quality of cotton of moderate levels of infestation by *Platyedra* (*Pectinophora*) *gossypiella* (Saund.), approaching those usual in the field. It was found that about two-thirds of the loss in value of lint was caused by reduced quality in 1956, when the cotton was harvested by snapping, whereas there were losses in yield but none in lint quality in 1955, when it was picked by hand. Loss in value of seed was caused about equally by reductions in yield and quality. Levels of infestation ranging up to about 50 per cent. infested bolls, with fewer than two larvae each, caused relatively small decreases in the value of the cotton produced. In the experiment in which the cotton was picked by hand, its value was greater when there was a light infestation than when there was none, and in the one in which it was snapped, a light infestation reduced the value of the crop by about ten dollars per acre. Although the differences in yield of seed and lint were not significant, there was a trend towards lower yields with increased infestation. Both experiments were carried out under very dry conditions. Wet weather in the month before harvest, when the bolls contained emergence holes, might have caused further reduction of yields and quality due to boll rot and lint staining.

Parencia jr. (C. R.), Davis (J. W.) & Cowan jr. (C. B.). **Further Field Tests with Systemic Insecticides employed as Seed Treatments.**—*J. econ. Ent.* **50** no. 5 pp. 614–617, 1 ref. Menasha, Wis., 1957.

Tests to compare Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] with Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] in seed treatments for the control of insects attacking cotton early in the season were carried out in Texas in 1956 [*cf. R.A.E.*, A **46** 91]. The seed was treated with 50 per cent. activated-charcoal dusts to give 6 or 8 lb. toxicant per 100 lb. and sown a month later at the rate of 33 or 25 lb. per acre, so that 1 lb. toxicant was used per acre. Plant emergence occurred

two weeks after sowing in April, when the weather was dry and cool, and one week after sowing in May, under better moisture conditions, with no appreciable difference between treated and untreated seed. Three weeks after emergence, both seed treatments and spraying with 1 lb. toxaphene per acre at weekly intervals significantly reduced the numbers of *Frankliniella* sp., Thimet applied to mechanically delinted (reginned) seed being more effective, apparently owing to better adherence, than Thimet on acid-delinted seed, and also better than Bayer 19639 on reginned seed. Applying about 1 lb. Thimet per acre in granules 4 ins. below the drill in which Thimet-treated seed was sown did not improve the control given by the seed treatment alone, and either was more effective after 3–5 weeks than treating the seed with a double dosage of Bayer 19639 in one test, though not in another; spraying with toxaphene was better than any other treatment after five weeks. Applying granules containing 2 per cent. Bayer 19639 at 55 lb. per acre three weeks after the emergence of plants from Bayer-treated seed did not materially reduce infestation. Seed treated with Thimet was widely used by growers in 1956, and satisfactory thrips control was obtained.

The toxaphene sprays were more effective than the seed treatments against *Psallus seriatus* (Reut.) and overwintered adults of *Anthonomus grandis* Boh. The seed treatments failed to control light infestation by *Liriomyza pusilla* (Mg.) that developed five weeks after plant emergence, but appeared slightly more effective than the sprays against a light infestation of *Aphis gossypii* Glov.

Edwards (C. A.), Beck (S. D.) & Lichtenstein (E. P.). **Bioassay of Aldrin and Lindane in Soil.**—*J. econ. Ent.* **50** no. 5 pp. 622–626, 5 figs., 20 refs. Menasha, Wis., 1957.

In investigations on the risks arising from the persistence of insecticides in soil, chemical analysis of soil samples can be used to indicate the presence of insecticide residues, and tests against insects to show their toxicity, and both are necessary if the maximum amount of information is to be obtained. Furthermore, both the extracted residue and the soil itself should be exposed to the test insects.

In experiments with adults of the Cinnabar strain of *Drosophila melanogaster* Mg. as the test insects, air-dried soil containing aldrin or lindane [almost pure γ BHC] was mixed with apple juice, to render it attractive, and the resultant sludge used to coat the bottom of a jar. When this had dried, adults of both sexes that were three days old were introduced, supplied with a little apple sauce as food and kept under continuous light and at almost constant temperature and humidity for 24 hours, after which they were observed for mortality. For bioassay, the concentrations of insecticide in the soil were adjusted to give suitable mortality values. Tests with soils containing known quantities of insecticide showed that aldrin was much more toxic than γ BHC to *D. melanogaster* and that soils differed markedly in their properties as carriers; the LD50's averaged 0·28, 0·41 and 0·9 parts per million for aldrin and 1·65, 2·25 and 4·71 for γ BHC in sandy loam, loam and muck soils, respectively. The adsorption of both insecticides was shown in tests with ten different soils to be correlated with the content of organic matter in the soil.

Direct bioassay of samples of Wisconsin muck, loam and sandy loam soils that had been treated with 20–200 lb. aldrin or 10–100 lb. γ BHC per acre in the spring of 1954, and were diluted to five levels with untreated soil and compared with five standard samples, showed the presence of 19–24, 27–35 and 76–90 per cent., respectively, of the γ BHC indicated by

chemical analysis after 22 months and 36–46, 170–274 and 293–522 per cent. of the aldrin after 25 months. These results indicate varying degrees of conversion of γ BHC to a less toxic and of aldrin in two of the soils to a more toxic compound. In view of the report that aldrin is readily oxidised to dieldrin [*R.A.E.*, A **46** 99], the samples were submitted to dieldrin analysis, and conversion to the latter was found to have occurred.

Dietrick (E. J.) & van den Bosch (R.). **Insectary Propagation of the Squash Bug and its Parasite** *Trichopoda pennipes* **Fabr.**—*J. econ. Ent.* **50** no. 5 pp. 627–629, 5 refs. Menasha, Wis., 1957.

Trichopoda pennipes (F.), a Tachinid parasite of Hemiptera, exists in the United States in at least three host-determined strains; one, occurring in the eastern States, attacks Coreids, mainly *Anasa tristis* (Deg.) [*cf. R.A.E.*, A **29** 442], another, in the south, attacks Pentatomids, mainly *Nezara viridula* (L.), and the third, in California, parasitises *Euryophthalmus cinctus californicus* Van D. As the Californian strain did not attack *A. tristis* even when caged alone with it, the eastern strain was introduced into California, from Connecticut in the summer of 1953, and techniques were developed during the summer of 1954 for the insectary propagation of the parasite and its host.

Anasa eggs were obtained from adults kept in a cheesecloth cage with a mature squash fruit as food, and the nymphs were confined on trays surrounded by a heated wire [*cf.* **34** 345] and fed first on cuttings of squash vine or rooted seedlings of squash grown on special trays and later on squash fruits; cheesecloth covers were put over the trays when adult emergence began. Similar trays and covers were used as oviposition units for the production of *Trichopoda,* as they minimised superparasitism and reduced mortality due to the repugnatorial fluid ejected by *Anasa.* The parasitised nymphs were transferred to a holding cage in which they were fed with rooted squash seedlings or large immature squash fruits, and the puparia of *T. pennipes* were collected from moist sand under the cage and transferred to dishes containing moist cotton in a large cheesecloth emergence cage. A high proportion of the parasites mated in this cage, but they were paired in four-inch shell vials to ensure maximum fertilisation.

During the summer of 1954, some 2,500 adults of *Trichopoda* were produced, and 551 mated females were liberated in three localities in California. They adapted themselves to field conditions and attacked *Anasa* vigorously. Parasitised *Anasa* nymphs were observed 100 yards from one release point, and 25 per cent. of those examined on 10th October 1954 bore *Trichopoda* eggs.

McGarr (R. L.). **Tests with Insecticides for Control of Cotton Insects in the Lower Rio Grande Valley.**—*J. econ. Ent.* **50** no. 5 pp. 632–634. Menasha, Wis., 1957. **Insecticides for Pink Bollworm and Boll Weevil Control in the Lower Rio Grande Valley in 1955 and 1956.**—*T. c.* pp. 672–674.

The results of field-plot tests with insecticides for the control of pests of cotton in the Lower Rio Grande Valley of Texas are given in these two papers, those for 1948–54 in the first and those for 1955 and 1956 in the second. Dusts were applied at about 10–20 lb. per acre in the first few years and at 20–30 lb. in 1955 and 1956, usually at intervals of 4–5 days, and applications were repeated if washed off by rain within 24 hours; a few sprays were similarly tested, and infestation records were made weekly.

In dusts applied six times in 1948, 10 per cent. chlordane in sulphur gave

the best control of *Anthonomus grandis* Boh. but the lowest yield of seed cotton; calcium arsenate and calcium arsenate with sulphur (1:1), with or without the addition of 0·25–0·5 per cent. parathion, gave good control and good increases in yield; 2–3 per cent. γ BHC in sulphur, with 10 per cent. DDT or methoxy-DDT (methoxychlor), gave only moderate control, but the former resulted in a considerable increase in yield and the latter in a poor one, presumably owing to damage by *Heliothis zea* (Boddie), which was poorly controlled.

In 1950, 8–9 dust applications of 2·5 per cent. dieldrin or 5 per cent. heptachlor or aldrin in sulphur were the most and calcium arsenate with sulphur the least effective against *A. grandis*; low-lime calcium arsenate with 1 per cent. parathion or BHC and 20 per cent. toxaphene with sulphur also gave relatively poor results; a dieldrin spray was effective against the weevil, but appeared to affect fruiting.

When applied five times in sprays in 1952, 0·375 lb. endrin or dieldrin per acre gave good control of both *A. grandis* and *H. zea*, whereas 0·53 lb. Metacide [methyl-parathion and parathion], methyl-parathion or heptachlor did not; none was effective against *Platyedra* (*Pectinophora*) *gossypiella* (Saund.), but Metacide, methyl-parathion and endrin checked *Aphis gossypii* Glov. Of dusts applied seven times in 1953, low-lime calcium arsenate with 1 per cent. methyl-parathion gave the best and 2·5 per cent. heptachlor in sulphur the worst control of *Anthonomus*; 2·5 per cent. dieldrin or 5 per cent. heptachlor in sulphur and 2·5 per cent. methyl-parathion with 5 per cent. DDT gave satisfactory control. Damage by *H. zea* was greatest for heptachlor and least for DDT, and only the latter gave appreciable control of *P. gossypiella*. *Psallus seriatus* (Reut.), which was injurious when the test began, was practically eliminated on all plots by the first applications. Yields were highest on the plots treated with the methyl-parathion mixtures. In 1954, when dusts were applied five times, the highest yield was obtained from one of 2 per cent. dieldrin with 1 per cent. methyl-parathion and 5 per cent. DDT, and the next (possibly slightly reduced by Tetranychid attack) from 1·5 per cent. endrin, followed by 2·5 per cent. dieldrin in sulphur and 1 per cent. methyl-parathion in low-lime calcium arsenate; all treatments gave satisfactory control of *A. grandis*, but not of a light infestation of *Platyedra*.

In 1955 and 1956, low-volume emulsion sprays were tested; they were applied at 5–7·5 U.S. gals. per acre with a six-row sprayer having 2–3 nozzles per row. In the first year, seven applications at approximately weekly intervals of 0·33 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] or endrin with 0·5 lb. DDT per acre caused noticeable reductions in infestation by *A. grandis* and fair increases in yield, but resulted in higher populations of mites and, in part of the Guthion plot, of *Aphis gossypii*. Six dust applications of 2·5 per cent. endrin with 10 per cent. DDT in sulphur or of 4 per cent. Guthion caused considerable reductions of *P. gossypiella*, the second being the better, and ten weekly applications of 5 per cent. Guthion dust gave very good control of heavy infestations of *P. gossypiella* and *Anthonomus* and quadrupled the yield.

In 1956, seven spray applications of 0·55 lb. Guthion or Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] with 1 lb. DDT per acre gave effective control of a light infestation of *P. gossypiella*, and caused noticeable and inappreciable reductions in *A. grandis* and good and fair increases in yield, respectively. Six applications of 0·49 lb. Guthion or endrin with 0·5 lb. DDT per acre in sprays, followed by two of Guthion and endrin dusts, respectively, made because the plots were too wet for spraying, gave effective control of *A. grandis*; endrin gave the greater increase in yield. Dusts containing 3 per cent. Guthion, with or without 10 per cent.

DDT, were effective against *P. gossypiella* and *A. grandis* and caused considerable increases in yield, with little difference between them, when 9–10 effective applications were made, and ten effective applications of 2 per cent. endrin in sulphur controlled a very heavy infestation of *A. grandis*, whereas calcium arsenate did not; both gave good increases in yield. One application of demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] soon after the first dust treatment controlled *Aphis gossypii* and Tetranychids throughout the season, except for an increase in *A. gossypii* on the calcium-arsenate plot towards the end of the season.

Lehr (R.) & Smith (F. F.). **The reproductive Capacity of three Strains of the Two-spotted Spider Mite Complex.**—*J. econ. Ent.* **50** no. 5 pp. 634–636, 9 refs. Menasha, Wis., 1957.

The mites used in the experiments described belonged to the strains of *Tetranychus telarius* (L.) from Waltham, Massachusetts, and Cranbury, New Jersey, that are susceptible and resistant, respectively, to organic phosphorus compounds, and the carmine form (*T. cinnabarinus* (Boisd.)) from Beltsville, Maryland that is susceptible to them [*cf. R.A.E.*, A **46** 57]. They were reared on bean leaves at daily average temperatures of 69–83°F. and relative humidities of 28–68 per cent. Pairing occurred between newly emerged and also older adults, and, in all three strains, oviposition began about two days after the emergence of the females, all of which laid both fertilised and unfertilised eggs throughout life if they mated on the first day. Fertilisation had no effect on the rate of oviposition or the number of eggs produced, and the eggs of *T. cinnabarinus* were not always distinguishable by colour from those of the other mites [*cf.* **46** 261]. The eggs of all three strains hatched in 4–5 days, and the young of both sexes passed through one larval and two nymphal instars, moulting at intervals of two days. Adult males and females appeared 10–10·5 and 11 days, respectively, after the eggs were laid, and the females lived for averages of 17·6–20·5 days and oviposited over average periods of rather more than two weeks. There were significant differences in the numbers of eggs produced by the three strains, isolated females of *T. cinnabarinus* and the Cranbury and Massachusetts strains of *T. telarius* producing averages of 5, 7·5 and 9·4 per day and maximum totals of 122, 153 and 212, respectively. Groups of five females gave similar results.

Tests with mixed populations developing from equal numbers of the susceptible and resistant strains of *T. telarius* showed that although the former had a higher rate of oviposition, the numbers of susceptible and resistant mites were approximately equal after three months, and similar tests with mixed populations of *T. cinnabarinus* and the resistant strain of *T. telarius* that, although the proportion of resistant hybrids greatly increased during the first 60 days, it subsequently declined, *T. telarius* becoming more and *T. cinnabarinus* less abundant. As the hybrids were evidently sterile, the specific status accorded to *cinnabarinus* [**46** 261] is justified. It is concluded from the experiments that resistance in a mite population would not be reduced by adding an equal number of a more prolific susceptible strain of the same species or by mixing with a closely related species to produce sterile hybrids.

Zimmack (H. L.) & Brindley (T. A.). **The Effect of the Protozoan Parasite *Perezia pyraustae* Paillot on the European Corn Borer.**—*J. econ. Ent.* **50** no. 5 pp. 637–640, 1 fig., 6 refs. Menasha, Wis., 1957.

Perezia pyraustae is an intracellular protozoan parasite that infects all stages of *Pyrausta nubilalis* (Hb.) [*cf. R.A.E.*, A **43** 243]. For further

investigations on its effect on the host, larvae and pupae of *P. nubilalis* were collected in Iowa in July and August 1955, and seven egg-laying females were reared from them. All these were found by examination of their eggs and post mortem examination to be infected with *Perezia*, and about 30 per cent. of the eggs in an egg-mass laid by an infected female were infected. All diseased larvae used in the tests were thus naturally infected transovarially and could be compared with uninfected larvae from the same egg-mass. All dead insects were dissected and examined microscopically to determine whether *Perezia* was present. The following is based on the authors' summary of the work.

In all, 360 first-instar larvae were reared on an uncontaminated synthetic medium [**38** 421], and 56 and 77 per cent., respectively, of the diseased and uninfected ones developed into adults, which were paired. On the average, infected females lived for 6·8 days and laid 82·8 eggs each, as compared with 9·9 days and 121·5 eggs for uninfected ones, and high proportions of the eggs laid were fertile in both groups.

Histological examination of infected ovaries showed that the nurse cells were the chief sites of infection in them, and *Perezia* spores were shown to pass from the region of the infected nurse cells into the developing oocyte. Infected males did not play any part in the transmission of the disease through pairing with uninfected females. The Malpighian tubules were the chief site of infection in late-instar larvae; infection in these organs was usually absent or light during the first and second instars but increased rapidly during subsequent development. The digestive tract was infected in more than half the diseased larvae.

DePew (L. J.) & Harvey (T. L.). **Toxicity of certain Insecticides for Control of Pale Western Cutworm attacking Wheat in Kansas.**—*J. econ. Ent.* **50** no. 5 pp. 640–642, 4 refs. Menasha, Wis., 1957.

Agrotis orthogonia Morr. caused severe damage to dry-land winter wheat in north-eastern Kansas during the spring of 1956, and emulsion sprays, applied at about 6 U.S. gals. per acre by means of a tractor-mounted sprayer on 19th or 25th April, were tested for its control. Larval populations before and after treatment were determined by means of a portable soil sifter. DDD (TDE) and DDT at 2 lb. and endrin at 0·25 lb. per acre gave excellent reductions in population, and aldrin and heptachlor at 1 lb., dieldrin at 0·5 lb. and toxaphene at 2 lb. decreased populations significantly, as compared with no treatment, but failed to give practical control within seven days. Working the soil after spraying slightly increased the effectiveness of the insecticides in most cases, but seemed unnecessary since some insecticides effected good control in undisturbed soil.

Fife (L. C.), Cowan jr. (C. B.) & Davis (J. W.). **Factors influencing Pink Bollworm Winter Carryover in central Texas.**—*J. econ. Ent.* **50** no. 5 pp. 642–644, 2 graphs, 3 refs. Menasha, Wis., 1957.

The following is based on the authors' summary. Investigations were carried out in 1952–56 to determine the factors influencing the winter survival of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) in central Texas. In tests with larvae from green cotton bolls, some of each generation entered diapause; this lasted for up to ten months, and diapause larvae were present in every month of the year. There were very few in July or August, but their numbers increased rapidly during September, and 93 per cent. or more of all larvae were in diapause by October. Special observations showed

that most survived in the open bolls and locks of cotton left in the field; survival was significantly higher in open bolls left on the soil surface and lower in bolls buried in November than in bolls on standing stalks or the soil surface that were buried in February, with no significant difference between the last two. Burying infested open bolls accelerated adult emergence, so that a larger proportion of adults appeared before cotton was available for oviposition. Diapause larvae also survived the winter in shed flowers and in free cocoons in the soil, but these sites are considered of minor importance.

In all environments, except those in which the bolls were buried in November, winter survival was significantly higher in two years of almost normal rainfall than in two of drought; mean and minimum temperatures appeared to be of little importance. It was found that the insect could survive from one cotton crop to the next in the fruiting forms of at least ten malvaceous plants, of which the most important were *Hibiscus esculentus* and *H. syriacus*.

The results suggest that deep autumn ploughing to bury cotton residues would be a practical method of controlling *P. gossypiella* in central Texas.

Turner jr. (E. C.). **Control of the Clover Root Curculio on Alfalfa.**— *J. econ. Ent.* **50** no. 5 pp. 645–648, 11 refs. Menasha, Wis., 1957.

In Virginia, damage to the roots of lucerne by larvae of *Sitona hispidulus* (F.) sometimes causes a substantial reduction in the yield of hay. During the summer of 1953, *Beauveria globulifera* was found attacking many of the newly emerged adults at Blacksburg, and it is believed that this fungus is an important natural enemy of the weevil.

In preliminary control tests with granular insecticides, plots treated with 2 lb. dieldrin per acre in April 1953 produced 44 per cent. more green hay in July than untreated ones, presumably because of the protection given to the roots against *S. hispidulus*; 2 lb. BHC and 4 lb. aldrin or toxaphene were less effective, but caused some increase. When applied in August 1953, dieldrin remained effective for three years, but aldrin for only one. Dieldrin and heptachlor at 4 lb. and chlordane at 20 lb. per acre gave excellent protection when applied in early September 1954 or March 1955 and dosages of 2, 2·5 and 5 lb., respectively, were effective in September 1955, when 2 lb. isodrin or lindane [almost pure γ BHC] and 5 lb. parathion also gave good control.

When applied at 1 lb. toxicant in 20 U.S. gals. spray per acre just before sowing in August 1955, dieldrin and heptachlor gave fair control, but endrin was ineffective.

Allen (W. W.), Nakakihara (H.) & Schaefers (G. A.). **The Effectiveness of various Pesticides against the Cyclamen Mite on Strawberries.**— *J. econ. Ent.* **50** no. 5 pp. 648–652, 27 refs. Menasha, Wis., 1957.

More than 50 compounds were tested for the control of heavy infestations of *Stenotarsonemus pallidus* (Banks) on field-grown strawberries in California in 1952–56. Sprays were applied at 800 U.S. gals. per acre, and the results showed that 0·4 lb. endrin per 100 U.S. gals. gave more than 90 per cent. reduction in population for periods of 3–5 weeks after application in April or May 1953, June or July 1954, July 1955 and July 1956 and was much more effective than any other material except azobenzene, which was tested at 2 lb. in July 1952 and 4 lb. in July 1954,

and Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide], tested at 0·5 lb. in July 1956; 0·4 lb. isodrin and 0·3 lb. dieldrin gave good results in some tests. Common acaricides, such as Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], chlorobenzilate [ethyl 4,4′-dichlorobenzilate], Genite [2,4-dichlorophenyl benzenesulphonate] and ovex [p-chlorophenyl p-chlorobenzenesulphonate], and most of the systemic compounds tested were ineffective, and non-systemic phosphates varied considerably in effect, diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] and parathion giving high initial mortality but permitting rapid reinfestation. Lindane [almost pure γ BHC] resembled parathion in effect.

Johansson (T. S. K.) & Johansson (M. P.). **The Effect of conditioned Flour on the Toxicity of Sodium Fluoride to *Tribolium confusum* Duv.** —*J. econ. Ent.* **50** no. 5 pp. 653–655, 2 graphs, 15 refs. Menasha, Wis., 1957.

As flour infested by *Tribolium confusum* Duv. becomes biologically modified [*cf. R.A.E.*, A **24** 613, etc.], experiments were carried out to determine whether such conditioned flour would affect the response of the adult beetles to low levels of insecticide. Flour in which populations of 1–12 beetles per g. had been kept at a constant temperature for three weeks was sifted to remove the insects, mixed with 0·5 per cent. sodium fluoride and supplied to newly-emerged adults as food at the rate of 0·5 g. per beetle. In almost all tests, the time required for 50 per cent. mortality to be reached was least in unconditioned flour and most in that conditioned by eight insects per g., the increase being from 24·3 to 30 and from 25 to 31·2 days, respectively, for males and females caged alone, from 26 to 31 and 22·6 to 27·6 days for single pairs, from 23·4 to 29 and 22·8 to 31·3 days when two males or two females were caged together, and from 22·3 to 30 and 20 to 29 days for males and females caged together in groups of five of each. Conditioning similarly afforded some protection to single insects in flour treated with 1 per cent. sodium fluoride, with no difference between levels of conditioning populations; beetles in unpoisoned conditioned flour suffered 0·6 per cent. mortality in 40 days.

Agrawal (N. S.), Christensen (C. M.) & Hodson (A. C.). **Grain Storage Fungi associated with the Granary Weevil.**—*J. econ. Ent.* **50** no. 5 pp. 659–663, 2 figs., 6 refs. Menasha, Wis., 1957.

The following is based on the authors' introduction and summary. Certain fungi, especially species of *Aspergillus*, are responsible for much damage to the germ and other deterioration in stored wheat. Numerous samples of wheat in which the germ was damaged were obtained from commercial storage bins in the United States, and examination showed that some contained light infestations of *Calandra* (*Sitophilus*) *granaria* (L.) or evidence of past feeding by this weevil, and of these some were heavily invaded by *A. restrictus*. Investigations were therefore made to determine whether infestation by *C. granaria* promotes invasion of the grain by this or other storage fungi. Replicated samples of infested and uninfested wheat were stored for 1–3 months at a relative humidity of 75 per cent. and a temperature of 25°C. [77°F.] and tested periodically for moisture content and injurious fungi, both wheat and insects being surface-sterilised before the experiment. The moisture content and mould count of the grain increased progressively with the original number of weevils added. *A.*

restrictus was the main fungus present, and inoculum of this and other species of the group of *A. glaucus* was found in the proventriculus and intestine of the weevils, was recovered from their excreta, and persisted in starved insects until after they died. When surface-sterilised weevils were added to autoclaved grain and this was kept at a relative humidity of 85 per cent. for five weeks, *A. restrictus* increased greatly. It was not found in samples kept free of insects, and it thus seems probable that infestation by *C. granaria* may serve to inoculate grain with storage fungi and promote rapid growth of some of them.

Cowan jr. (C. B.), Davis (J. W.) & Parencia jr. (C. R.). **Control of the Boll Weevil and Bollworm with Chlorinated Hydrocarbon and Phosphorus Insecticides in 1956.**—*J. econ. Ent.* **50** no. 5 pp. 663–666, 3 refs. Menasha, Wis., 1957.

Parencia jr. (C. R.), Cowan jr. (C. B.) & Davis (J. W.). **Control of Cabbage Loopers on Cotton with Boll Weevil and Bollworm Insecticides in central Texas in 1956.**—*T. c.* pp. 666–668, 3 refs.

The first of these papers contains the results of experiments on the control of *Anthonomus grandis* Boh. and *Heliothis zea* (Boddie) on irrigated cotton in central Texas in 1956 [*cf. R.A.E.*, A **46** 51] with low-volume sprays or dusts, applied at about five-day intervals in most cases. *H. zea* was the most important pest in all but one experiment, and about 1 lb. DDT per acre for its control was included in the treatments and applied to the control plots in experiments directed primarily against *A. grandis*; either 0·6 lb. endrin or 1·5 lb. Paris green per acre was also applied on 8th–10th August, where necessary, to control *Trichoplusia ni* (Hb.).

In sprays applied nine times in July–August, and including DDT, 0·25 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] and 0·375 lb. dieldrin per acre gave good control of *A. grandis*, and methyl-parathion and EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] at 0·5 lb. and endrin at 0·36 lb. per acre (without DDT) gave equal and significant control, but 2 lb. toxaphene was less satisfactory unless 0·5 lb. malathion was added to the last five applications; 2 lb. Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] per acre was rather ineffective and was the only one of these treatments that did not increase the yield substantially. Nine applications of 0·4 lb. Guthion per acre in a dust including DDT were more effective in controlling *A. grandis* and resulted in a significantly higher yield than any of the sprays. In a late-season experiment, in which *H. zea* was unimportant, four spray applications between 7th and 21st August of 0·3 lb. endrin or of 2 lb. toxaphene with 1 lb. DDT per acre against *A. grandis* gave good control, which was slightly improved in each case by the addition of 0·5 lb. malathion per acre.

Eight applications between 9th July and 10th–13th August of 2 lb. toxaphene, 0·375 lb. Guthion or 2·5 lb. malathion per acre, all with DDT at about 1 lb. per acre, or of 0·5 lb. Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide], without DDT, in sprays, and of 0·44 lb. Guthion with DDT or 0·53 lb. Thiodan without, in dusts, all gave significant control of both *A. grandis* and *H. zea* and highly significant increases in yield, but the Thiodan spray was less effective against *H. zea* and resulted in significantly lower increases in yield than the other treatments. In six applications between 20th July and 9th August, begun after considerable injury by *H. zea* had occurred, 0·5 lb. Thiodan per acre in a spray and 0·34 lb. endrin and 0·56 lb. Thiodan in dusts gave significant control of both insects and significant increases in yield.

In a single test of four spray applications between 29th June and 16th July on non-irrigated cotton, Guthion at 0·75 lb. alone or at 0·375 lb. with 0·75 lb. DDT per acre was more effective than 0·5 lb. Guthion alone or 2 lb. toxaphene with 1 lb. DDT against both insects; the sprayed plants had been treated with toxaphene, Guthion or Dipterex against *Psallus seriatus* (Reut.) on 8th and 15th July and were more heavily infested by *H. zea* than untreated ones.

In the second paper, the authors report that *T. ni* was unusually harmful to cotton in central Texas in 1956, causing severe foliage damage and loss of staple length, and compare the results against it given by the treatments against *A. grandis* and *H. zea* described in the first. Only applications made in late July and August affected *T. ni*. The sprays containing methyl-parathion, malathion or EPN with DDT and the endrin spray and dust all gave good control, and the Thiodan dust and spray were considered promising. The spray of toxaphene with DDT and the dust of Guthion with DDT gave fairly good control, but DDT alone was ineffective, and sprays containing DDT with Guthion, dieldrin or Dipterex gave poor control.

JENSEN (D. D.). **Transmission of Peach Yellow Leaf Roll Virus by *Fiebcriella florii* (Stål) and a new Vector, *Osbornellus borealis* DeL. & M.**—*J. econ. Ent.* **50** no. 5 pp. 668–672, 19 refs. Menasha, Wis., 1957.

Peach yellow leaf-roll virus is a highly virulent strain in the complex known as western X-disease and cherry buckskin. Five Cicadellids, including *Fieberiella florii* (Stål), which was thought to be of little economic importance, have been reported as vectors of strains in this complex [*cf.* *R.A.E.*, A **44** 382, etc.], and there is no evidence of any restriction to particular strains among them. In a large peach orchard near Yuba City, California, harbouring relatively large numbers of *F. florii*, the number of trees newly infected with peach yellow leaf-roll increased from seven in 1954 to 45 in 1955 and 129, with 21 in adjoining plantations, in 1956. As *F. florii* was found in no other orchards in the region, and only 60 widely scattered trees were found to be newly infected elsewhere in Yuba and throughout Sutter and Butte counties, it was considered to be the main or only vector responsible for the outbreak in this important peach-growing district. In late May 1956, nymphs of *F. florii* were observed migrating to the trees from sweet clover [*Melilotus*] growing against the trunks. The clover and trunks were sprayed with DDT on 30th May and the entire orchard with parathion on 2nd June. This apparently gave complete control of the insect, and only three new cases of the disease occurred in 1957. In cherry orchards in Solano county, in which another strain of the virus had been spreading, small numbers of *Colladonus geminatus* (Van D.), another vector of the complex, were collected in 1956, but none of *F. florii*.

In greenhouse tests in 1955, nymphs of *F. florii* from the orchard at Yuba were caged on infected peach trees. After 31 days, 40 adults and 19 last-instar nymphs were present. The adults were caged in groups of about five for a fortnight on eight healthy peach seedlings, of which three became infected, and for a further ten days on eight more seedlings, of which two became infected. The seven survivors were transferred in a single batch successively to two celery plants [*cf.* **45** 202], on which they fed for 18 and 21 days and which became infected. The nymphs were left on the virus source for a further 14 days and the adults from them similarly caged on four peach seedlings, of which two became infected. The six that survived fed successively on two celery plants and infected them, and all the surviving

adults (7) were then allowed to feed until they died on a further celery plant, which also became infected.

In 1956, young nymphs of *F. florii* and *Osbornellus borealis* DeLong & Mohr, collected together on myrtle (*Myrtus communis*) and California privet (*Ligustrum ovalifolium*), were caged on infected peach for 45 days, after which the adults of *F. florii* were caged in groups of 4–6 on nine successive celery plants each and then singly or in groups of 2–5 on 3–4 peach seedlings. They fed for 3–4 days on each celery plant and the first peach seedlings and for 7 days on later peach seedlings, and transmitted the virus to 35 of 36 celery plants but to only one of ten peach seedlings. Groups of 1–3 adults of *O. borealis*, caged successively on three celery plants for seven days and 1–2 peach trees for five days or less, infected seven of nine celery plants and one of four peach trees. These tests suggest that celery is much more susceptible than peach to infection transmitted by these vectors.

Glass (E. H.). **The Occurrence of Resistance to TDE (DDD) in the Red-banded Leaf Roller.**—*J. econ. Ent.* **50** no. 5 pp. 674–676, 1 graph, 4 refs. Menasha, Wis., 1957.

DDD (TDE), which had proved effective against *Eulia* (*Argyrotaenia*) *velutinana* (Wlk.) on apple in New York State since 1949, failed to control the second generation in one orchard in 1954 and was unsatisfactory in increasing numbers of others in 1955 and 1956, when about 5–10 per cent. of the orchards in western New York were probably affected. Field tests carried out in 1948–56 confirmed the decreasing effectiveness of a single spray of 1–2 lb. 50 per cent. wettable DDD per 100 U.S. gals. against the first generation in 1955 and of 1–2 against the second in 1955 and 1956, when parathion and lead arsenate maintained their efficiency. Laboratory experiments made in 1956, in which larvae of a strain of *E. velutinana* from an orchard in which DDD had not been used and two from orchards in which it had been used since 1949 were confined on leaves bearing various spray deposits, showed that the LD50's for DDD were 19, 64 and 76 parts per million, respectively, and the LD95's 43, 350 and 425; the corresponding figures for parathion were 19, 16 and 7 and 24, 22 and 11. It is concluded that the insect has acquired a measurable degree of resistance to DDD in some parts of New York.

Davis (J. W.), Cowan jr. (C. B.) & Parencia jr. (C. R.). **Thrips Control on Cotton with Phosphorus Insecticides.**—*J. econ. Ent.* **50** no. 5 pp. 676–678, 5 refs. Menasha, Wis., 1957.

In further tests in 1954–56 on the control of *Frankliniella* sp. on early cotton in central Texas [*cf. R.A.E.*, A **42** 87], phosphorus compounds were compared with the recommended chlorinated-hydrocarbon insecticides; they were applied in emulsion sprays at 2–2·5 U.S. gals. per acre, or in dusts, usually at weekly intervals. The quantities given are of active ingredient per acre.

Counts of thrips made six days after spraying in 1954 showed that, when applied three times in June, 0·25–0·75 lb. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate], 0·75 lb. Strobane [a chlorinated mixture of α-pinene isomers with a chlorine content of about 66 per cent.] and 0·125 lb. methyl-parathion were less effective than 0·75 lb. toxaphene or 0·25 lb. methyl-parathion, both of which gave fair control. In 1955, 0·1 lb. dieldrin in a spray was more effective than 0·06–0·22 lb. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] in

sprays and than 0·13 lb. Guthion or 0·14 lb. endrin in dusts, when two applications were made in June, and 0·75 lb. toxaphene was more effective than 0·06–0·11 lb. Guthion, but not than 0·75 lb. Strobane, when applied in sprays three times between 30th May and 14th June.

When applied in sprays four times between 17th May and 7th June 1956, 0·1 lb. dieldrin and 0·125 lb. Guthion gave significantly better control of *Frankliniella* than 0·5–1 lb. Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] or 0·31 lb. malathion, but not of *Anthonomus grandis* Boh. or *Psallus seriatus* (Reut.); all reduced insect populations considerably, and all but 0·5 lb. Dipterex and 0·125 lb. Guthion resulted in good increases in yield. When sprays were applied twice, on 16th and 30th May, 0·1 lb. dieldrin and 0·25 lb. EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] were about equally effective, 0·125 lb. Guthion much less so, and 0·25 lb. methyl-parathion and 1 lb. Dipterex rather ineffective. All the compounds reduced populations of *A. grandis* considerably when applied a third time on 6th June at double dosages, dieldrin giving the highest increase in yield, followed by methyl-parathion.

Nishida (T.), Bess (H. A.) & Ota (A.). **Comparative Effectiveness of Malathion and Malathion-Yeast Hydrolysate Bait Sprays for Control of the Melon Fly.**—*J. econ. Ent.* **50** no. 5 pp. 680–684, 4 graphs, 11 refs. Menasha, Wis., 1957.

Experiments were carried out in Hawaii in 1956 to determine whether the addition of yeast hydrolysate increases the effectiveness of malathion sprays against *Dacus cucurbitae* Coq. [*cf. R.A.E.*, A **44** 431]. When wild plants growing in abandoned cucumber and water melon fields were freed from adults by shaking and then sprayed, 2, 4 and 8 lb. 25 per cent. wettable malathion with 1, 2 and 4 lb. yeast hydrolysate, respectively, per 100 U.S.A. gals. gave higher immediate kills than malathion without attractant, but all sprays were ineffective after 1–2 days. Applying a spray of 1 lb. yeast hydrolysate per 100 U.S. gals. on the third day after treatment increased the kill again, showing that the malathion was still toxic and that the decline in effectiveness had been due to loss of attraction. When 1, 2 or 4 lb. yeast hydrolysate was added to sprays of 2 lb. 25 per cent. malathion per 100 U.S. gals., the increase in kill due to increase in attractant was too small to be of practical value. In field tests, thorough application once or twice a week of sprays of 2 lb. malathion, with or without 1 lb. yeast hydrolysate, per 100 U.S. gals. to maize plants round the edges of cucumber and cantaloupe plots caused a consistent and marked decline in adult populations in all plots, with no significant difference between populations or in percentage of fruits infested. The inconsistency in the results obtained is not understood, but may be due to the method employed, since mortality resulted from the return of the adults to the sprayed plants in the first tests and to contact action on adults already present on the plants in the later ones.

Grossman (R. M.), Miller (B. S.), Jones (E. T.) & Johnson (J. A.). **A Laboratory Technique for obtaining Quantities of comparable Hessian-fly infested and uninfested Wheat Plants.**—*J. econ. Ent.* **50** no. 5 pp. 688–690, 3 figs., 1 ref. Menasha, Wis., 1957.

The authors give details of a method of growing wheat plants in tanks of nutrient solution, developed in the course of a study of the biochemical factors involved in the resistance of wheat plants to *Mayetiola* (*Phytophaga*) *destructor* (Say), and discuss the results obtained with it. Adults of the Cecidomyiid were released under tents over some of the tanks when the

plants were three weeks old, and both infested and uninfested plants were normal and compared favourably in physical characteristics with plants grown in sand or soil cultures; 94–95 per cent. infestation was obtained. and all the immature stages of the insect appeared to develop normally.

Ebeling (W.) & Pence (R. J.). **Relation of Particle Size to the Penetration of Subterranean Termites through Barriers of Sand or Cinders.**—*J. econ. Ent.* **50** no. 5 pp. 690–692, 1 fig., 1 ref. Menasha, Wis., 1957.

Reticulitermes hesperus Banks can be maintained for a time in glass tubes containing fine sand that has been moistened by capillarity. The termites have a strong tendency to tunnel upwards, but are reluctant to burrow from a sand of one particle size to one of larger particles. A sand of which not more than 5 per cent. is retained on a 10-mesh screen and not more than 5 per cent. passes through a 16-mesh screen forms an impenetrable barrier, as the smaller particles are too large to be pushed aside or carried and the larger ones too small to leave adequate spaces for the passage of the termites, and sands of larger particle size also prevent movement if they are compressed to reduce interstices to a minimum. Figures are given showing the way in which tunnelling is arrested in columns of 50-mesh sand by an upper layer of sand of 10–16 mesh, packed sand of 6–16 mesh or crushed volcanic cinders of 10–16 mesh, and the use of sand for sealing off earth-filled structures from the main foundations of houses is discussed. It is also reported that when layers of asphalt were laid on infested sand in tubes, the termites needed 3–4 weeks to penetrate a layer 0·125 inch thick and did not attempt to penetrate it if it contained 1 per cent. DDT, chlordane, dieldrin, lindane [almost pure γ BHC], methoxy-DDT (methoxychlor) or toxaphene. This finding is also being applied in practical tests.

Hough (W. S.). **Effect of Mouse-control Spray of Endrin on Insect Life in Orchard Ground Cover.**—*J. econ. Ent.* **50** no. 5 pp. 692–693, 1 ref. Menasha, Wis., 1957.

Spraying the soil with 2·8 pints endrin emulsion concentrate (1·6 lb. toxicant per U.S. gal.) in 100 gals. spray between mid-October and mid-March to control mice has become established practice in recent years in orchards in Virginia, and the effect of this on the larvae and pupae of *Parornix* (*Callisto*) *geminatella* (Pack.), the pupae of *Eulia* (*Argyrotaenia*) *velutinana* (Wlk.), and their parasites and hyperparasites, which overwinter in or among fallen apple leaves, was investigated in 1957.

In one test, fallen leaves were brought into the insectary in March and thoroughly sprayed with the endrin mixture or left untreated, and in another some of the ground cover in an orchard was sprayed on 16th March. Sprayed and unsprayed leaves were put in cloth-lined cages, and the insects that emerged were recorded. Almost all were parasitic Hymenoptera, mainly members of genera of which some species are known to be parasites or hyperparasites in the complexes associated with *P. geminatella*, *E. velutinana* or both; more than 32 per cent. were *Apanteles*, mainly *A. ornigis* Weed, the most important parasite of *P. geminatella* observed in 1955–57. The other principal groups, in order of abundance, were Ichneumonids and Eulophids of several genera, with possibly some Pteromalids.

There was no evidence that the spray affected the overwintering stages of *P. geminatella*, *E. velutinana* or of any of the parasites or hyperparasites, with the possible exception of the Ichneumonids. Limited data indicated that Syrphids were also unaffected.

Saunders (J. P.) & Krueger (H.). **A rapid Method for counting Larvae of the Confused Flour Beetle.**—*J. econ. Ent.* **50** no. 5 p. 693, 2 refs. Menasha, Wis., 1957.

In studies with *Tribolium confusum* Duv., it is often necessary to enumerate the larvae in various media; a method of doing this, based on the ability of many beetle larvae to cling to rough paper when it is tilted, and a test of its efficiency are described. A mixture of dried white maize meal and cracked grain was infested with adults of *T. confusum*, and the latter were driven off 7–10 days later by the application of a strong light to the scattered medium. This was then thoroughly mixed, and portions of it were spread on black construction paper and gently shaken off after about 40 seconds. Most of the living larvae present remained on the paper, and they were counted and removed. The process was repeated 2–3 times, after which the samples were stored for 21 days at room temperature and the adults that emerged counted. The results showed that 96 per cent. or more of the larvae were recorded in three transfers of samples of 1, 2 or 5 g. medium and 95·4 per cent. in four transfers of 10-g. samples.

Wolfenbarger (D. O.) & Robinson (F. A.). **Honey Bee Colony Weight Changes in Relation to Malathion Bait Spray Applications.**—*J. econ. Ent.* **50** no. 5 pp. 694–695, 4 refs. Menasha, Wis., 1957.

In the campaign against *Ceratitis capitata* (Wied.) in Florida in 1956 [*cf. R.A.E.*, A **45** 249], 0·5 lb. malathion per acre in concentrated bait-sprays was applied by aeroplane to very large areas at ten-day intervals. Records of the daily colony weights of 1–2 colonies of honey bees in June–August 1952–56 in a sprayed area showed that the application of the sprays had no effect on the changes in weight, and it is apparent that insufficient malathion was applied to the colony site and its surroundings to have reduced it.

Lanchester (H. P.). **An emergency Summer Treatment of Pear Leaf Blister Mite.**—*J. econ. Ent.* **50** no. 5 pp. 695–696, 2 refs. Menasha, Wis., 1957.

Eriophyes pyri (Pgst.) was unusually injurious to the unfolding buds of pear in some areas of the Pacific Northwest of the United States in 1956. Sprays of demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] at 6, 3–4 and 1·5 U.S. quarts 21 per cent. emulsion concentrate in 600 U.S. gals. spray per acre were applied in late spring or early summer to orchards in which all trees were generally infested (up to 70 per cent. leaf surface affected), in which all trees were partially infested, and in which only a few terminals were infested, respectively, and resulted in normal tree growth and a satisfactory crop, with no spray damage to leaves or fruits and hardly any mite injury on the harvested pears, though all stages of the mite could still be found if enough plant material was dissected.

Asquith (D.). **N-Methyl-1-naphthyl Carbamate as a killing Agent for the Periodical Cicada.**—*J. econ. Ent.* **50** no. 5 p. 696. Menasha, Wis., 1957.

Applications of 50 per cent. wettable Sevin (1-naphthyl N-methylcarbamate) at 2 lb. per 100 U.S. gals. in high-volume sprays and at 6 lb. per 100 U.S. gals. in low-volume mist-concentrate sprays in late May 1957 gave high mortality of adults of *Magicicada septendecim* (L.) in Maryland, and tests in which two plots of infested apple trees near York Springs, Pennsylvania, were treated on 7th June 1957 showed that 1 and 2 lb. 50 per

cent. wettable Sevin per 100 U.S. gals., in high-volume sprays applied with a spray gun, caused almost complete and complete mortality, respectively, in 24 hours. It is not known for how long toxicity was maintained.

Richmond (C. A.) & Husman (C. N.). **An improved Technique for determining Pink Bollworm Infestations in Cotton Samples.**—*J. econ. Ent.* **50** no. 5 pp. 696–697, 1 fig., 1 ref. Menasha, Wis., 1957.

Infestation of seed cotton, cottonseed and crop débris by *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) is usually assessed by hand examination, which is time-consuming. In the method described, the infested material is moistened and put in cans with a capacity of some 4 gals., each fitted with a trap bottle at the apex of a cone top of 18-mesh wire gauze, and these are stored on racks in a room fitted with overhead ultraviolet lights and kept at temperatures of 83–89°F. and 57–75 per cent. relative humidity, either in an upright position or sloping towards the lights. These conditions terminate the diapause and stimulate pupation and adult emergence, and the results obtained indicate that about 95 per cent. of the larvae give rise to adults within 90 days if they are maintained.

Blanchard (R. A.) & Bigger (J. H.). **Effects of Soil Insecticides on full-grown Corn Earworm Larvae, Pupae, and Adults.**—*J. econ. Ent.* **50** no. 5 pp. 697–698. Menasha, Wis., 1957.

In tests made in Illinois in 1955, to determine whether insecticides applied to the soil in early May would affect larvae of *Heliothis zea* (Boddie) that enter it in late July or August or the resulting pupae or adults, aldrin at 4·9, heptachlor at 4·1 and dieldrin at 2·4 lb. per acre were applied in emulsion sprays to plots immediately before the soil was disked to a depth of 4 ins. and a week before maize was sown. Full-fed larvae were caged on the soil on 27th July and allowed to enter it, and living pupae in the soil and adults in the cages were counted in the middle of August. The results showed that the treatments had little effect on the insects, though rather fewer adults emerged from treated than from untreated plots. The proportion of living larvae at the end of the experiment was smaller in untreated than in treated soil, probably owing to their destruction by ants, which were numerous in untreated soil, but absent from the treated plots.

Ivy (E. E.), Scales (A. L.) & Gorzycki (L. J.). **A new systemic Insecticide for Cotton Insects.**—*J. econ. Ent.* **50** no. 5 pp. 698–699, 4 refs. Menasha, Wis., 1957.

In tests in 1954 of more than 200 chemicals, applied on an activated-carbon carrier to cotton seed at 4 lb. insecticide per 100 lb. seed before sowing, Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] gave promising results as a systemic insecticide. It was more persistent in its effect than Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate], Am. Cyanamid 12009 [O,O-diethyl S-n-propylthiomethyl phosphorodithioate] or Am. Cyanamid 12013 [O,O-diisopropyl S-isopropylthiomethyl phosphorodithioate] [*cf. R.A.E.*, A **43** 431] against *Anthonomus grandis* Boh., *Frankliniella tritici* (Fitch), *Thrips tabaci* Lind. and *Bucculatrix thurberiella* Busck, and than the last two against *Aphis gossypii* Glov., *Tetranychus tumidus* Banks and *Estigmene acraea* (Dru.). None had any effect on *Heliothis zea* (Boddie). Doses of 4, 8, 16 or 32 lb. Thimet per 100 lb. seed caused no reduction in germination or loss of stand, but the two higher ones resulted in small necrotic lesions on the leaves.

When applied as a foliage spray, 2 lb. technical Thimet per acre gave satisfactory control of *Anthonomus* by contact action but did not kill adults put on the plants one day later, indicating that quantities significantly toxic to this weevil are not absorbed by the leaves. *Aphis gossypii* and *T. tumidus* were controlled for two weeks or more by a spray of 0·25 lb. Thimet per acre to the foliage, but demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] was slightly more effective.

Fye (R. E.), Walker (R. L.) & Hopkins (A. R.). **Susceptibility of the Boll Weevil in South Carolina to several Insecticides.**—*J. econ. Ent.* **50** no. 5 pp. 700–701, 4 refs. Menasha, Wis., 1957.

As *Anthonomus grandis* Boh. was reported in 1955 to have become resistant to chlorinated-hydrocarbon insecticides in Louisiana, laboratory experiments were carried out in South Carolina in 1956 to ascertain whether resistance had developed there also. Series of concentrations of several insecticides were applied topically in acetone to weighed adults, which were then caged with fresh cotton squares and observed for mortality after 48 hours. The LD50's in μg. per g. body weight for endrin were 1·67, 8·7, 208·7 and 4·88 for overwintered adults collected on seedling cotton and adults reared from punctured squares collected in summer and autumn and from bolls collected in autumn, respectively, in Florence County, where considerable amounts of chlorinated hydrocarbons had been used for several years, 7·11, 0·472 and 3·14 for those reared from squares collected in summer and autumn and bolls collected in autumn in Georgetown County, where very little cotton is grown and very little insecticide used, and 1,160 and 213 for those reared from squares in summer and autumn in Darlington County, where failure of endrin to afford control was reported in July.

The results obtained later in the season with adults reared from squares collected from the field in which resistance was first observed in Darlington County and from others near it showed that migration from the resistant population had had some influence on populations 0·3 but not 0·6 or 1·2 miles away.

Tests with Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] revealed no trend towards resistance in any locality, and late-season tests with γ BHC indicated some resistance in field-collected adults from Darlington County as compared with those from Florence County, but little difference between adults reared from squares in the two counties. The LD50's for these and the other insecticides tested are shown in a table.

Tests to determine whether mixtures of organic phosphates were more toxic than would be expected from a simple additive effect showed that a combination of EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] and malathion (1:5) was only slightly more so, but a mixture of malathion and endrin (5:2) was 16 times as effective as endrin alone.

Harwood (R. F.), Nelson (W. L.) & Telford (H. S.). **Seed Treatments of Wheat for Control of the Great Basin Wireworm.**—*J. econ. Ent.* **50** no. 5 pp. 702–703, 2 refs. Menasha, Wis., 1957.

In 1953–56, various insecticides were applied to wheat seed at 0·5–2 oz. per bushel in wettable powders with a little water or 0·3 per cent. methyl-cellulose solution, with or without fungicides, and tested for protection of the plants against larvae of *Ctenicera pruinina noxia* (Hyslop) in Washington. In laboratory tests of germination, only lindane [almost

pure γ BHC], alone or with Aroclor 5460 (a chlorinated polyphenyl) [*cf. R.A.E.*, A **43** 51] seriously reduced the proportion of strong plants obtained when the seed was germinated either immediately or after storage at room temperature for 78 days. In field plots sown late in the autumn in 1953 and 1954, aldrin, heptachlor, dieldrin and γ BHC (with or without Aroclor) gave good protection, and the first two are recommended, as they are cheaper than dieldrin and safer than γ BHC. Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] was less effective. In plots sown in the spring of 1956, aldrin and heptachlor at 1 oz. were the most effective materials tested, but 1–2 oz. Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] and Bayer 16259 [O,O-diethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] showed promise, as also did the same amounts of Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] and Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] on carbon. The two organic mercury fungicides tested did not appear to reduce insecticidal effectiveness. None of the seed treatments had any effect on yield, and control is probably necessary only in areas of chronic heavy damage or where valuable seed stock is being propagated.

Wilcox (J.) & Howland (A. F.). **Tests with Thimet on Strawberries and Turnips.**—*J. econ. Ent.* **50** no. 5 pp. 703–704. Menasha, Wis., 1957.

Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] was applied at 0·5 and 1 lb. per acre on 27th February 1956 for the control of *Tetranychus telarius* (L.), *Myzus persicae* (Sulz.), *Aphis fabae* Scop. and *Macrosiphum* sp. on strawberry in southern California. It caused excellent reductions in the Aphid populations, counted on four dates in March and three in April, and of the mite, counted twice in April, when applied in low-volume emulsion sprays to the foliage or in low- or high-volume sprays to the bottom of furrows that were made 4 ins. to one side of each row and 4 ins. below the crowns of the plants and closed after treatment, the field being subsequently irrigated on 1st March. Much less control was obtained when 2 per cent. granules were applied to the furrows. The two rates of application were equally effective against the mite, but the higher one was significantly more effective against the Aphids.

When applied to furrows in the seed bed and raked over just before turnips were sown in November 1955, 2–4 lb. Thimet per acre in granules reduced populations of *Rhopalosiphum pseudobrassicae* (Davis) and *Myzus persicae* on 9th February, just before harvest, by 93–99 per cent., but 1 lb. per acre in granules and 0·5–2 lb. per acre in sprays were unsatisfactory. Treatments made on 10th January showed no significant difference in control between foliage sprays and granules applied to furrows on each side of the plant row at the same dosages, 2–4 lb. Thimet per acre giving reductions of 90 per cent. or more in the Aphid population at harvest. Samples of turnips from all treatments contained less than 0·004 part Thimet per million.

Velasco H. (R.). **Insectos presentes en el equipo de movimiento de granos de los silos de Guacara, Estado Carabobo, Venezuela.** [Insects present in the Grain-moving Equipment of the Silos of Guacara, State of Carabobo, Venezuela.]—*Agron. trop.* **5** no. 2 pp. 87–97, 8 refs. Maracay, 1955. (With a Summary in English.)

Examination of samples of grain taken from various parts of the grain-moving apparatus at a large storage installation in north-central Venezuela

in 1955 showed that all were infested by *Calandra* (*Sitophilus*) *oryzae* (L.) and *Tribolium castaneum* (Hbst.) and smaller proportions by numerous other insects, a list of which is given. These included *Carpophilus dimidiatus* (F.), *Gnathocerus maxillosus* (F.) and *Caulophilus latinasus* (Say), none of which had previously been recorded from Venezuela.

Guagliumi (P.). **Suplemento a la lista de los insectos de la caña de azúcar en Venezuela (1953–1955).** [Supplement to the List of Sugar-cane Insects in Venezuela (1953–55).]—*Agron. trop.* **5** no. 2 pp. 99–104, 1 ref. Maracay, 1955. (With a Summary in English.) **Algunas plagas nuevas de la caña de azúcar en Venezuela.** [Some new Pests of Sugar-cane in Venezuela.]—*Acta cient. venez.* **7** no. 3 pp. 66–67, 2 figs., 6 refs. Caracas, 1956.

The first of these two papers is supplementary to a list already noticed [*R.A.E.*, A **44** 221] and includes records of some 20 species and subspecies of insects observed infesting sugar-cane in Venezuela for the first time in 1953–55. Those of economic importance are stated to be *Euetheola* (*Dyscinetus*) *bidentata* (Burm.) [*cf.* **45** 72], *Elasmopalpus lignosellus* (Zell.) and three subspecies of *Aeneolamia varia* (F.).

In the second paper, in which notes are given on the more important pests of sugar-cane in Venezuela in recent years, it is stated that *Euetheola bidentata*, *E. humilis* (Burm.) and *Elasmopalpus lignosellus* cause dead-hearts in young cane similar to those caused by *Diatraea*, that a weevil of the genus *Compsus* recently described by Kuschel as *C. serrans*, sp. n., feeds on the young leaves at night, and that several subspecies of *A. varia* and *Delassor tristis* (F.) are apparently spreading to sugar-cane from wild grasses.

Guagliumi (P.). **Contribuciones al estudio de la candelilla de las gramíneas en Venezuela. II. Los cercópidos causantes de la candelilla. A.** *Aeneolamia* (= *Tomaspis*) *varia* (**F.**) **y sus subespecies.** [Contributions to the Study of the Blight of Graminaceous Plants in Venezuela. II. The Cercopids causing Blight. A. *A. varia* and its Subspecies.]—*Agron. trop.* **5** no. 3 pp. 135–194, 22 figs., 3 maps, 21 refs. Maracay, 1955. **B.** *Aeneolamia flavilatera* (**Urich**) **y sus subespecies.** [B. *A. flavilatera* and its Subspecies.]—*Op. cit.* **6** no. 2 pp. 51–73, 3 figs., 1 map, 8 refs. 1956. **C.** *Ae. reducta montana* **Fennah. D.** *Ae. lepidior* (**Fowl.**). [C. *A. r. montana*. D. *A. lepidior*.]—*T. c.* no. 3 pp. 123–133, 1 fig., 1 map, 10 refs. 1956. **III. Cuadro de la distribución geográfica de las especies de** *Aeneolamia* **Fennah y de sus plantas hospederas señaladas en Venezuela.** [Table showing the geographical Distribution of the Species of *Aeneolamia* and of their Food-plants recorded in Venezuela.]—*T. c.* no. 4 pp. 165–194. 1957. (With Summaries in English.)

In the first of these further parts of a paper on the Cercopids that cause blight of graminaceous plants, particularly sugar-cane, in Venezuela [*cf.* *R.A.E.*, A **45** 72], the author states that the species concerned are *Aeneolamia varia* (F.), *A. flavilatera* (Urich), *A. lepidior* (Fowler), *A. reducta* (Lall.) and *Delassor tristis* (F.). He reviews the classification of species of these and related genera [*cf.* **40** 388] and the morphology of *A. varia*, and gives a list of 20 subspecies of the latter that occur in Venezuela, including four new ones, with information on their distribution, food-plants and morphological characters. All but one are recorded from

sugar-cane, but only nine are regarded as pests of it, though a few of the others are injurious to cereals or other graminaceous plants.

In the second part, he describes the typical subspecies of *A. flavilatera*, from British Guiana, and lists the six subspecies that occur in Venezuela, of which two are new, with information on their distribution there, food-plants and characters. Four of them are recorded from sugar-cane, but none causes appreciable damage to any plant. In the third part, he gives similar information for *A. reducta montana* Fennah, the only representative of its species in Venezuela, and *A. lepidior*, which both occur on sugar-cane there and are of potential importance, and in the final part he lists the species and subspecies of *Acneolamia* and *Delassor* under the States and localities in which they occur, with their food-plants.

Kern (F.) & Szumkowsky (W.). **Viaje de reconocimiento entomológico realizado en helicóptero a la parte sur del país.** [Entomological Reconnaissance Trip by Helicopter to the South of Venezuela.]—*Agron. trop.* **6** no. 3 pp. 115–121, 1 map. Maracay, 1956. (With a Summary in English.)

Observations over several years have indicated that there is a migration of *Laphygma frugiperda* (J. E. Smith) from the south of Venezuela towards the north, where rice and maize are widely grown and are damaged by the larvae, and the existence of summer breeding foci near the Apure and Arauca rivers has been reported. With a view to the initiation of a programme of biological control by means of natural enemies in such foci, two surveys were carried out by helicopter in 1956. Indications of the existence of foci were found, but the rainy season was well advanced at the time, and further observations at the end of the dry season are considered necessary.

Malaguti (G.). **La "hoja blanca", extraña enfermedad del arroz en Venezuela.** [White Leaf, a strange Disease of Rice in Venezuela.]—*Agron. trop.* **6** no. 3 pp. 141–145, 1 fig., 9 refs. Maracay, 1956.

Malaguti (G.), Díaz C. (H.) & Angeles (N.). **La virosis "hoja blanca" del arroz.** [The White-leaf Virus of Rice.]—*T. c.* no. 4 pp. 157–163. 1 fig., 7 refs. 1957. (With a Summary in English.)

It is reported in these two papers that rice in the State of Portuguesa, Venezuela, was severely affected in 1956 by a disease apparently identical with that known as rice stripe in Japan, where the vector of the causal virus has been found to be *Delphacodes striatella* Fall. The symptoms are described. Experiments described in the second paper showed that transmission in Venezuela was effected by two unidentified Cicadellids that are common on rice and wild grasses there. The incubation period was 23–40 days.

Franco do Amaral (S.). **Efeito de diferentes concentrações de BHC sôbre o bicho mineiro** *Perileucoptera coffeella* **(Guérin-Méneville).** [Effect of different Concentrations of BHC on *Leucoptera coffeella*.]—*Arq. Inst. biol.* **23** (1956) pp. 21–33, 4 pls., 1 fig., 8 refs. São Paulo, 1957. (With a Summary in English.)

Details are given of an experiment in São Paulo in 1955 showing that dusts of 0·5, 1 and 1·5 per cent. γ BHC are equally effective against adults of *Leucoptera* (*Perileucoptera*) *coffeella* (Guér.) on coffee. The lowest concentration is therefore recommended.

Autuori (M.). **Contribuição para o conhecimento da saúva** (*Atta* spp.—**Hymenoptera-Formicidae**). **VI—Infestação residual da saúva.** [Contribution to the Knowledge of *Atta* spp. VI. Residual Infestation.]—*Arch. Inst. biol.* **23** (1956) pp. 109–116. São Paulo, 1957. (With a Summary in English.)

In this part of a series on leaf-cutting ants of the genus *Atta* in Brazil [*cf. R.A.E.*, A **41** 254, etc.], the author illustrates by means of an example the impossibility of freeing a fairly extensive area from these ants by insecticides applied to the nests once only. This is largely because incipient colonies are overlooked. Inspections and treatment every 3–6 months are therefore necessary.

González B. (J. E.). **Algunas observaciones ecológicas sobre los tortricidos enrolladores de la hoja del algodonero en el Perú.** [Ecological Observations on the Tortricid Leaf-roller of Cotton in Peru.]—*Bol. trim. Exp. agropec.* **5** no. 3 pp. 2–6. Lima, 1956.

Serious damage to cotton in Peru has been caused in recent years by *Platynota* sp. and *Eulia* (*Argyrotaenia*) *sphaleropa* (Meyr.), outbreaks of which have usually followed treatment of the cotton for one year or more with organic insecticides. The injury is most severe in spring and autumn, since natural enemies are favoured by summer conditions, and activity is reduced by low temperatures in winter. No insecticides capable of affording control are known. *Eulia* is commonest in coastal or low-lying districts, and *Platynota* on higher ground. The natural enemies of these two Tortricids include *Trichogramma* sp., which affords up to 100 per cent. parasitism of the eggs, *Apanteles* sp. and *Nemorilla angustipennis* (Tns.), which attack the larvae, parasitism reaching 48 and 35 per cent., respectively, in January, and two Ichneumonids, *Pimpla* sp. and *Itoplectis* sp., which together parasitise over 50 per cent. of the pupae. In addition, there are numerous predators. In the absence of insecticide treatments, these together normally keep the Tortricids under control.

Wille (J. E.). **Recomendaciones para el control del** *Aleurothrixus floccosus*. [Recommendations for the Control of *A. floccosus*.]—*Bol. trim. Exp. agropec.* **5** no. 3 pp. 11–14. Lima, 1956.

A serious outbreak of *Aleurothrixus floccosus* (Mask.) on *Citrus* in the Palpa Valley, Peru, began in 1953, and was still in progress in 1956. Females of this Aleyrodid lay their eggs in the lower surfaces of the leaves, and the larvae, which were very numerous, suck the sap and excrete honeydew, which weighs down the leaves and even whole branches. Five or six generations develop in a year. The recommendations for control comprise spraying the trees with water, to wash off the deposits of honeydew, and applying a spray of 2 per cent. oil emulsion and 0·1 per cent. parathion 1–2 days later. Treatment at least five times a year is necessary.

de Meester-Manger Cats (V.). *Solanum dulcamara* **L. (bitterzoet) als mogelijke bron voor bladrolvirus.** [*S. dulcamara* (Bittersweet) as a possible Source of Potato Leaf-roll Virus.]—*Tijdschr. PlZiekt.* **62** pt. 4 pp. 171–173, 1 ref. Wageningen, 1956. (With a Summary in English.)

Solanum dulcamara is a wild plant known to be susceptible to infection with the potato leaf-roll virus, but it was not known whether it harbours

it in nature. It is the only common perennial solanaceous plant in Holland, and investigations were therefore made in which plants were collected in 25 localities and examples of *Myzus persicae* (Sulz.) allowed to feed on them for 24 hours and then on *Physalis floridana* for an equal period. All plants of *S. dulcamara* appeared to contain the virus, though they showed no symptoms, and in further tests the Aphid transmitted it from *S. dulcamara* to potato. The virus was inherited through the seed and appeared to be a natural component of the organism of *S. dulcamara*.

DE MEESTER-MANGER CATS (V.). **Korte overdrachttijd van bladrolvirus.** [A short Transmission Period for Leaf-roll Virus.]—*Tijdschr. PlZiekt.* **62** pt. 4 pp. 174–176, 7 refs. Wageningen, 1956. (With a Summary in English.)

In tests with batches of five examples of *Myzus persicae* (Sulz.), not starved, a feeding period of 15 minutes on *Physalis floridana* infected with the virus of potato leaf-roll followed immediately by one of 15 minutes on healthy *Physalis* seedlings proved long enough for transmission of the virus, and similar results were obtained when the source of the virus was potato.

NIJVELDT (W.). **Phaenologische waarnemingen omtrent de koolgalmug (*Contarinia nasturtii* Kieff.).** [Phenological Observations on *C. nasturtii*.]—*Tijdschr. PlZiekt.* **62** pt. 4 pp. 209–213, 1 fig., 2 refs. Wageningen, 1956. (With a Summary in English.)

Observations on the date of emergence of the adults of *Contarinia nasturtii* (Kieff.) in Holland by means of emergence cages placed over the soil were begun in 1936, in order to facilitate the timing of control measures against this Cecidomyiid on cruciferous crops. The results obtained in various districts in 13 years are shown in a diagram, and it is concluded that emergence sometimes begins as early as the last ten days of May, though it does not usually do so until the first half of June.

BERGOLD (G. H.) & RIPPER (W. E.). **The polyhedral Virus of *Heliothis armigera* (Hbn.) (Lepidoptera: Noctuidae).**—*Nature* **180** no. 4589 pp. 764–765, 2 figs., 6 refs. London, 1957.

SMITH (K. M.) & RIVERS (C. F.). **The polyhedral Virus of *Heliothis armigera* (Hbn.).**—*T. c.* no. 4592 p. 928, 2 refs.

It is pointed out in the first paper that *Heliothis armigera* (Hb.) has long been known to be subject to a wilt disease [*cf. R.A.E.*, A **24** 280, etc.]. In view of the possible use of the virus for purposes of control, it was decided to investigate the causal agent. Larvae that had died, presumably of a virus disease, in the autumn of 1956 in rearings of the insect at the Gezira Research Farm, in the Sudan, were examined, and one batch of five showed the presence of polyhedra. These were isolated as well as the small number of larvae permitted, and the virus particles liberated from them. The polyhedra and the rod-shaped particles are described, and the name *Borrelina armigera* is proposed for the virus.

In the second paper, the authors point out that the virus of this nuclear polyhedral disease of *H. armigera* had already been isolated and characterised [**46** 198] and state that experiments on its use for control of *H. armigera* are in progress in Uganda.

Morison (G. D.). **A Review of British Glasshouse Thysanoptera.**—*Trans. R. ent. Soc. Lond.* **109** pt. 16 pp. 467–520, 34 figs., 7 pp. refs. London, 1957.

This summary of information on Thysanoptera in glasshouses in Britain, which is based on the literature and the author's own observations, contains general accounts of collection and preservation methods and the life-cycle, bionomics, behaviour and natural enemies of thrips, detailed reviews of the 13 native and 13 introduced species already present in glasshouses, together with briefer accounts of seven native and some 11 foreign species regarded as of potential importance, and a key to the females and, in most instances, the males of the 29 genera concerned. The aspects dealt with for the individual species include morphology, synonymy, world distribution in the open and under glass, distribution in Britain, food-plants, seasonal occurrence, bionomics, nature and importance of the damage caused, status as vectors of virus diseases (if any), natural enemies, and control. *Thrips tabaci* Lind. [*cf. R.A.E.*, A **20** 483; **22** 481; **24** 556; **28** 135; **29** 146] is the commonest of the four native species of more than casual occurrence in glasshouses; the others are *Taeniothrips atratus* (Hal.) [*cf.* **40** 362], which damages carnations and other flowers under glass and appears to be most numerous in north-eastern Scotland, *Thrips fuscipennis* Hal. [*cf.* **20** 483; **24** 557; **28** 133; **29** 146], which is recorded damaging the leaves of peach in glasshouses in north-eastern Scotland [*cf.* also **31** 178], and *T. major* Uzel [*cf.* **21** 487–488; **22** 232], which on rare occasions damages flowers in late summer, and all are polyphagous. *Heliothrips haemorrhoidalis* (Bch.) is the most widespread and injurious of the introduced species, of which others of importance include the *Gladiolus* thrips, *Taeniothrips simplex* (Morison) [*cf.* **40** 224, 362] and *Liothrips vaneeckei* Priesn. [*cf.* **23** 222; **24** 107], which injures lily bulbs in glasshouses and in the open.

Juvin (P.). **Contribution à la mise au point d'une méthode de lutte contre la cécidomyie des siliques du colza** (*Dasyneura brassicae* **Winn.**).—*C.R. Acad. Agric. Fr.* **43** no. 14 pp. 738–742. Paris, 1957.

Experiments on the control of *Dasyneura brassicae* (Winn.) on rape by means of insecticides were carried out in northern France in 1956–57. In those in 1956, complete control was given by sprays of parathion at 0·54 lb. per acre, but other materials were much less effective. In 1957, sprays were applied to plots at 36–90 gals. per acre, and the results were estimated from the numbers of larvae that emerged from pods picked up to 11 days later, and by dissection of pods at intervals. Percentages of control were calculated by means of Abbott's formula [*R.A.E.*, A **13** 331], and were 96–99 for parathion or diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] at 0·54 and methyl-parathion at 0·27 and 0·54 lb. per acre in emulsion sprays, and 88–95 for parathion in oil emulsion at 0·54 lb. parathion per acre, and endothion [2-(O,O-dimethyl phosphorothiolomethyl)-5-methoxy-4-pyrone] at 0·45 lb. and a mixture affording 0·243 lb. diazinon and 0·54 lb. DDT per acre, also in emulsion sprays. There were no significant differences between these, but Dipterex [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] at 0·54 lb. per acre gave only 45–55 per cent. control, diazinon at 0·18 lb. only 50 per cent., and toxaphene at 8·1 lb. only 20–40 per cent. Parathion proved effective immediately on application and remained so for a fortnight, and two applications a fortnight apart resulted in 97 per cent. kill of larvae. A single application made after flowering might therefore be sufficient.

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